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Economic Intelligence Report

DEVELOPMENTS IN SOVIET MACHINE BUILDING



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DEVELOPMENTS IN SOVIET MACHINE BUILDING*

Summary and Conclusions

During the second year of the Seven Year Plan (1959-65) the machine building sector of the Soviet economy** performed creditably. Most of the annual production goals for commodities were achieved, and in the case of some of the commodities that did not attain plan goals, such as excavators, chemical equipment, and hydrogenerators and turbogenerators, production in 1960 exceeded that of 1959 by more than 20 percent. Incidentally, few of the commodity groups attained the level of production originally foreseen for 1960 by the now superseded Sixth Five Year Plan (1956-60).

It appears probable that the machine building sector will fulfill and possibly will exceed the original production goals of the Seven Year Plan. Two factors appear to justify this expectation: (1) annual capital investments in the machine building industries apparently are larger than called for under the original terms of the Seven Year Plan, and (2) there is specific evidence that production targets for 1965 in various industrial branches and commodities are being increased.

In spite of general gains in the volume of production in the machine building sector during 1960, output of many types of machines and equipment remained insufficient for the requirements of the national economy. In particular, a shortage of replacement parts continued to be a nagging problem.

* The estimates and conclusions in this report represent the best judgment of this Office as of 15 November 1961.

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** Soviet economists do not identify a machine building sector for purposes of statistical reporting but rather a machine building and metalworking sector. This sector produces a complete assortment of machinery and equipment ranging from such extremes as an ocean liner to a horse-drawn one-bottom plow. This report is concerned with those branches of the machine building and metalworking sector that produce instruments, transformers, tractors, hydrogenerators and turbogenerators, motor vehicles, antifriction bearings, agricultural machinery, metallurgical equipment, turbines, construction equipment, chemical equipment, machine tools, and mainline locomotives and freight cars.

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Product technology in Soviet machine building during 1960 generally reflected a gradual improvement. Significant developments included the completion of the world's largest blast furnace and an apparent technological breakthrough in the cooling of large generators. The program for the specialization of plants has evidenced only moderate progress through 1960. Similarly the program for increased mechanization and automation, although showing some progress, was termed inadequate by Soviet planners, and the steps taken early in 1961 to bolster production of machine tools probably were occasioned by the desire for more rapid automation. The Seven Year Plan program for the standardization of parts and components apparently has not been completely effective during the first 2 years of the plan period, and it may be that with the improvement of planning and interplant cooperation this program will make better progress.

Soviet foreign trade in machinery and equipment increased 51 percent in the first 2 years of the Seven Year Plan, rising from the level of 7,438 million rubles* in 1958 to 11,254 million rubles in 1960. Similarly the share of exports and imports of machinery and equipment compared with total Soviet foreign trade increased from 21.5 percent in 1958 to 25.2 percent in 1960. Communist China continued to be the largest single trading partner, receiving 44 percent of Soviet exports of machinery and equipment in 1960. East Germany remained the major supplier, furnishing the USSR in 1960 with about 35 percent of its imports of machinery and equipment. In 1960 the Sino-Soviet Bloc was a market for 86 percent of Soviet exports of machinery items and was a source of 72 percent of Soviet imports of these items. Exports by the USSR of machinery and equipment for complete plants made up the largest trade category within this commodity group, amounting to 2.3 billion rubles in 1960, about one-half of all Soviet exports of machinery and equipment.

In spite of the relatively small volume of imports of machinery and equipment from non-Bloc countries, these imports are important because they are primarily high-priority items in such fields as chemical equipment and instruments that incorporate advanced technology.

* Ruble values in foreign trade and all other value data relating to the machine building industry in this report are given in old rubles (ruble values in use before the Soviet currency reform of 1961) and may be converted to US dollars at the rate of exchange of 4 rubles to US \$1, which is believed to reflect relative costs of similar machine building in the US and the USSR.

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I. Introduction

The Soviet Seven Year Plan (1959-65) for the development of the national economy of the USSR provides for increases of more than 100 percent in the annual output of most branches of the machine building sector in 1965 compared with that of 1958. In addition to provisions for greatly expanding production facilities, the plan envisions that 70 percent of the increases will be obtained from the increased productivity of labor -- that is, from more efficient management and production methods (inclusive of the replacement of outmoded machinery with modern, more productive types). Moreover, the products of industry in 1965 are to be modern by world standards. It is the purpose of this report to examine the progress that representative branches of the machine building industry have made toward these goals thus far in the Seven Year Plan period, particularly in 1960, and on that basis to speculate on the likelihood that annual plans for 1965 will be fulfilled. Particular attention is given to progress in several programs on which increases in the productivity of the machine building industry and the utility of its products are to be based. These programs are not new in the USSR but are emphasized in the directive of the Seven Year Plan. The programs provide for attaining larger and more economic scales of production through standardization on a minimum number of models of products for any particular application, the specialization of plants in the large-scale production of a small assortment of products with the maximum number of parts common to more than one product, the introduction of special-purpose machinery with high output rates to exploit the economic advantages of large orders in specialized plants, and, concurrently with the elimination of duplicate models, replacement of obsolete products in production with new models of the most modern design. It should be noted that the elimination of multiplicity of models of machines that are designed to perform essentially the same job leads not only to larger scale production of the standardized model but also to a reduction in required parts inventories in the hands of the end users. This reduction in the multiplicity of parts to be inventoried is a particularly important factor in the USSR, where shortages of spare parts have been chronic for years.

II. General

At the close of 1960 the Soviet machine building sector was well on its way toward fulfillment of production goals for the Seven Year Plan. During 1960 the gross output of the machine building sector increased 16 percent, according to official reports, compared with an increase of 10 percent for all industry. This increase greatly exceeds the average annual increase of 10 percent required to meet the targets of the Seven Year Plan for the machine building sector.

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Most of the branches of the Soviet machine building industry met their assigned annual plan goals, and several achieved an output well ahead of plan requirements. Only in the case of motor vehicles and bearings was production at a rate that would have to be increased greatly in order to reach the plan goals for 1965. This performance, generally good with respect to the goals of the Seven Year Plan, was below the goals foreseen for most of the commodities by the subsequently supplanted Sixth Five Year Plan (1956-60). Only chemical equipment, instruments, and transformers were produced in greater quantities in 1960 than was provided for under the Sixth Five Year Plan. The volume of Soviet production of selected machinery is shown in the table* and is presented graphically in Figure 1.** Indexes of growth for individual branches of Soviet machine building are presented graphically in Figures 2 and 3.**

By the end of 1960 it was evident that many production targets originally established for the Seven Year Plan could be raised and that Soviet planners had seriously underestimated the requirements of the national economy for some of the products of the machine building sector. As a result, production goals for some items of machinery have been revised upward for the remaining years of the plan period. For example, the construction equipment industry was directed to increase production of excavators by one-third in 1960, and during the period 1961-65 there are to be manufactured, in addition to the original plan, 29,600 excavators, 15,000 bulldozers, 3,300 motor graders, 10,000 loaders, and many other construction machines. The Seven Year Plan for 1965 for supplying new tractors to Soviet agriculture was revised from 1,240,000 tractors to at least 1,610,000 and possibly as many as 1,800,000 tractors. In December 1960 the machine tool industry was directed to increase its plan goal for 1965 from 36,200 units of metalforming machine tools to 55,000 units.*** Similarly the agricultural machinery industry will be required to produce agricultural machinery worth almost 12.9 billion rubles in addition to the original plan. In at least two other instances -- the instrument industry and the chemical equipment industry -- production in 1962 or 1963 is expected to attain the original plan goals for 1965.

These production programs, however, have necessitated increased capital investment in the machine building sector and, to some degree, a deviation from the specialization program through a farming out of production orders to plants engaged primarily in producing unrelated products. Evidence of increased investment can be seen in the case of the construction equipment industry. Coupled with a directive establishing new plan goals for that industry was an announcement that it was being given a supplementary investment allocation of 867 million rubles.

* The table follows on p. 6.

** Following p. 8.

*** In May 1961 it was publicized on competent authority that the goal for 1965 of 200,000 metalcutting machine tools had been raised to 270,000.

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It is not surprising that both production targets for many types of equipment and investment allocations for the construction equipment branch of Soviet industry should be increased sharply during the second year of the Seven Year Plan. Certainly the original goals of the Seven Year Plan for many branches of machine building were less ambitious than those of the Sixth Five Year Plan, probably because of the constraints imposed by an inadequate raw materials base. It is likely that a combination of factors -- an improvement in the supply of raw materials and a recognition that the original Seven Year Plan goals would not provide the assortment and quantity of producer goods necessary for a rapidly expanding economy -- caused a reassessment of these goals during 1960, resulting in the shifting of some resources.

Not all areas of machine building enjoyed substantial increases in production during the first 2 years of the plan period. Production of motor vehicles, agricultural machinery, railroad freight cars, and tractors dipped below the levels of 1958 during 1959, yet all but freight cars showed a slight gain in 1960. In the case of motor vehicles the drop in production in 1959 was attributable to shortages of sheet steel and dislocations in production caused by model changes. In the case of tractors, agricultural machinery, and electric locomotives, the industry was going through a model changeover. Railroad freight cars presented a slightly different situation. Production of larger cars continued during the first 2 years of the plan period, and although there was a decrease in the number of cars produced, the total capacity of the new cars increased.

In general, the machine building sector of the Soviet economy has been able to procure an adequate supply of materials, components, and electric power. There are, however, several areas of machine building that have encountered serious supply problems. Delays in the delivery of materials and equipment components reportedly have hampered production of turbines and electric locomotives. The transformer branch of the electrical equipment industry has continued to be handicapped by a lack of cold-rolled silicon sheet steel and a critical shortage of copper. The failure of a few plants to deliver component parts on schedule has disrupted production in several major plants of the motor vehicle industry, a complaint that has its echo with some variations in the instrument industry.

Although a general increase in production was accomplished in the machine building sector in the second year of the plan period, output of many types of machines and equipment remained insufficient to satisfy the requirements of the national economy. The USSR has been obliged to lean heavily on imports to supplement its inadequate output of chemical equipment. The construction equipment industry is not producing either a sufficient volume or an adequate assortment of equipment to satisfy the needs of the construction industry. Late in 1960, high-precision ball

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Table

Production of Selected Machinery in the USSR
1958-60 and 1961 and 1965 Plans

Item	Unit of Measure	1958	1959	1960	1961 Plan	Original 1965 Plan	Revised 1965 Plan
Instruments	Billion rubles a/	7.39	9.42	11.11	13.44	18.5 to 19.2	18.5 to 19.2
Transformers	Thousand megavolt- amperes	30.5	40.5	49.2	N.A.	90	90
Tractors	Thousand units	219.7	213.5	238.5	268.0	375	440
Hydrogenerators and turbo- generators	Thousand megawatts	5.2	6.5	7.9	N.A.	17.5 to 18.4	17.5 to 18.4
Motor vehicles	Thousand units	511.1	495.0	523.6	N.A.	750 to 856	750 to 856
Antifriction bearings	Million units	325.1	350.7	369.7	N.A.	650	650 to 770
Gross agricultural machinery	Billion rubles	8.5	6.4	7.3	9.0	N.A.	N.A.
Metallurgical equipment	Thousand metric tons	176.1	200.5	217.8	N.A.	305	305
Of which:							
Rolling mills	Thousand metric tons	86.9	102.3	120	150	200 to 220	200 to 220
Turbines	Thousand megawatts	6.6	7.6	9.2	11.8	18.7 to 20.4	18.7 to 20.4
Excavators	Units	10,165	10,210	12,290	15,265	N.A.	24,400
Bulldozers	Units	10,963	11,264	11,200	19,500	16,300	24,500
Tractor-scrappers	Units	2,660	2,398	2,950	4,950	N.A.	8,450
Motor graders	Units	2,663	2,835	3,135	3,650	N.A.	10,000
Loaders	Units	N.A.	N.A.	2,600	3,960	N.A.	N.A.
Pneumatic-tire cranes	Units	475	693	N.A.	8,000 b/	3,000	13,000 b/

a. Ruble values are given in old rubles (ruble values in use before the Soviet currency reform of 1961) and may be converted to US dollars at the rate of exchange of 4 rubles to US \$1.

b. Including truck cranes and pneumatic-tire cranes.

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Item	Unit of Measure	1958	1959	1960	1961 Plan	Original 1965 Plan	Revised 1965 Plan
Chemical equipment	Million rubles	1,121	1,757	2,240	2,840	3,500 to 3,700	3,500 to 3,700
Metalcutting machine tools	Thousand units	138	147	154	N.A.	190 to 200	270
Metalfforming machine tools	Thousand units	26.2	29.3	29.5	N.A.	36.2	55
Locomotives, mainline	Units	1,056	1,437	1,699	2,128	2,550 to 2,700	3,105
Of which:							
Diesel	Units	712	1,002	1,303	1,453	N.A.	N.A.
Electric	Units	344	435	396	675	N.A.	N.A.
Alternating current	Units	1	42	98	N.A.	N.A.	N.A.
Direct current	Units	343	393	298	N.A.	N.A.	N.A.
Freight cars	Units	40,300	38,600	36,400	N.A.	N.A.	N.A.

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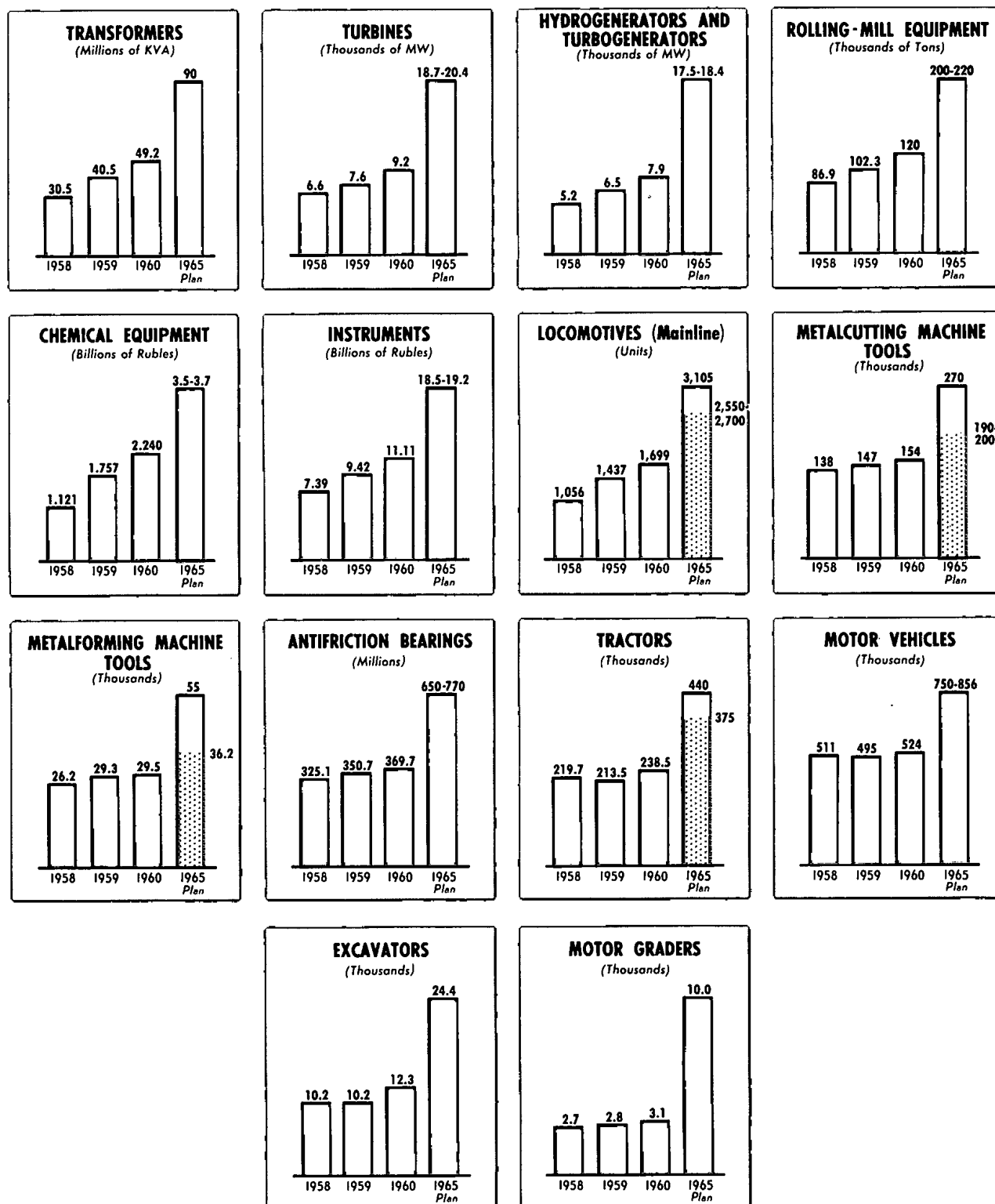
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bearings and tapered roller bearings were lacking for completing the assembly of a quantity of machine tools, mining machinery, metallurgical equipment, and transport equipment. The domestic demand for instruments and for hydrogenerators and turbogenerators continues to be pressing in spite of an impressive growth in the rate of production. Production of alternating-current electric locomotives did not keep pace with the electrification of the railroads. Finally, production of replacement parts for many types of machines and equipment is inadequate, and their chronic short supply continues to plague machine building, agriculture, construction, and other sectors of the national economy.

The trend toward specialization of plant facilities, which had been reemphasized in the instructions for Soviet industrial development in the directive of the Seven Year Plan, made some progress in 1960. New plants in the transformer industry specialized in certain small and medium models of distribution transformers. In the motor vehicle industry, two plants (ZIL and YaAZ) discontinued models being produced by other plants, and newly commissioned plants (in Zaporozh'ye and Zavolzh'ye) entered production as specialized producers of single product lines. The long-term trend of specializing in certain products by plants of the tractor industry was reaffirmed in 1960 with the designation of the Serp i Molot Engine Plant to supply engines for the Stalingrad Tractor Plant and eventually for the Khar'kov Tractor Plant, thus freeing production space in the latter two plants for increased production of tractors. Specialization by plant is the custom in the locomotive manufacturing branch as typified by the conversion in 1960 of the former Proletarskiy Locomotive Repair Plant into the Leningrad Locomotive Plant with the special assignment of producing a new model of diesel locomotive with hydraulic drive. Among the machine building factories, arrangements for specialization in the production of certain types and sizes of rolling mills, industrial traveling cranes, heavy presses, and the like have been assigned by the planning authorities. Many exceptions to these assignments have been made, however, as noted in the protests lodged in the Soviet press by the plants whose production schedules have been distorted by the unanticipated receipt of orders for machinery, production of which had been relinquished to other plants. The same situation seems to obtain in the construction equipment industry. In the antifriction bearings industry, moreover, the assignment of orders for particular sizes to various plants was so poorly handled in some instances that either automated machinery was not fully employed in one plant while another plant produced similar bearings on conventional machinery at higher cost or orders for similar bearings were so split between plants that none of them could afford to install automated machinery. This apparent lack of progress in specialization is, of course, temporary and reflects the many difficulties involved in the detailed planning of a vast and rapidly growing industrialized economy.

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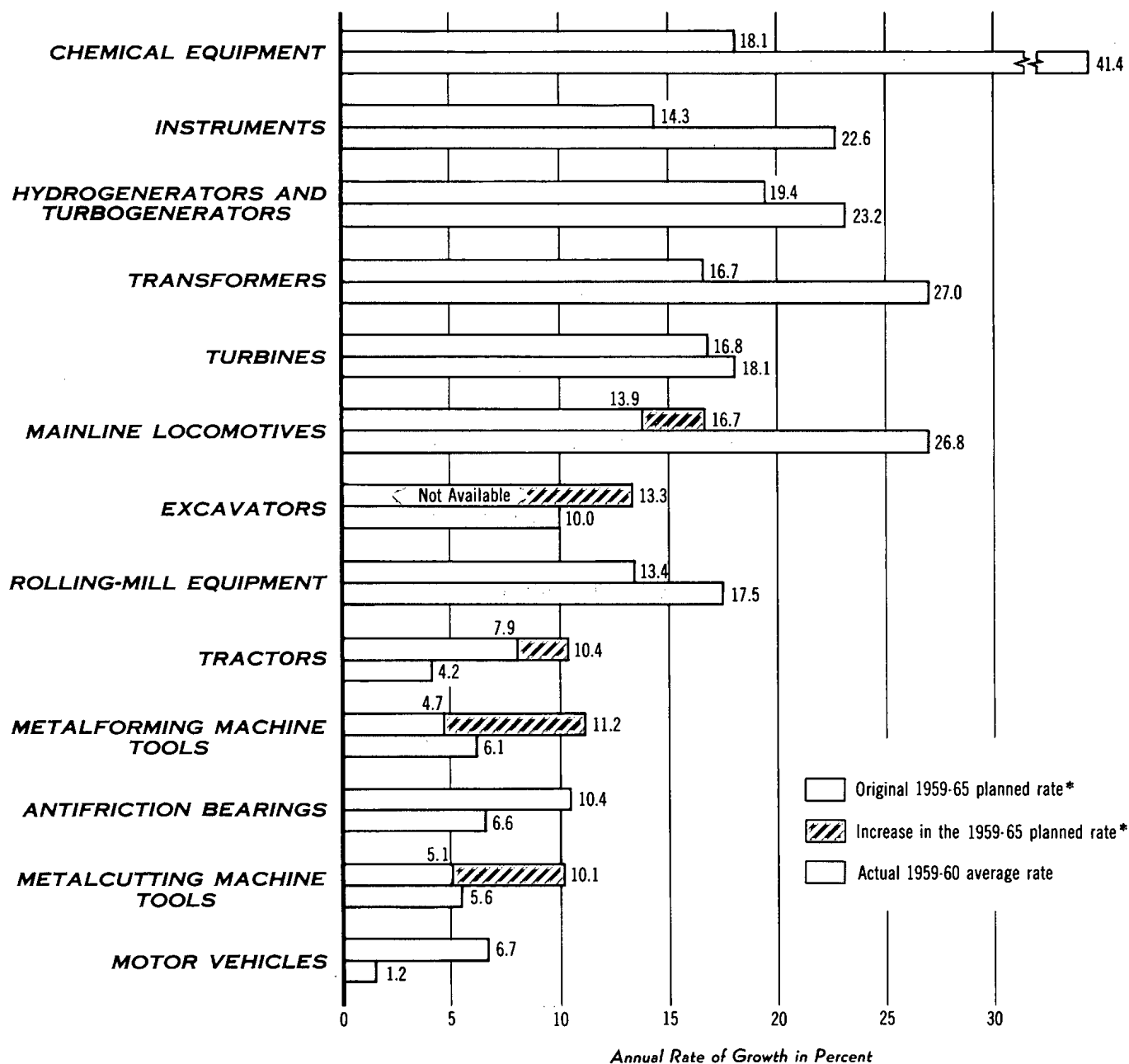
USSR: Production of Selected Machinery, 1958-60 and 1965 Plan



Original 1965 Plan Goal, where known to differ from present goal.

Figure 2

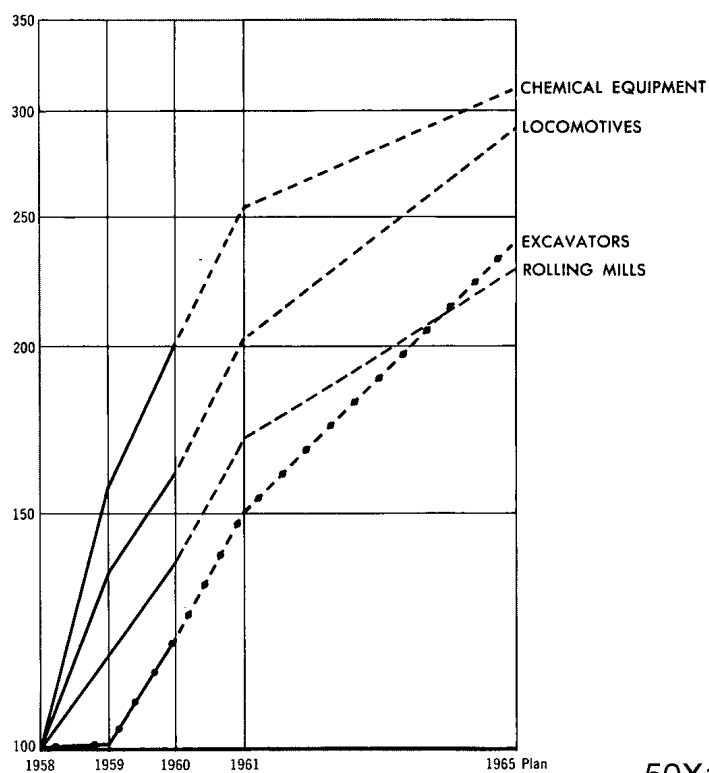
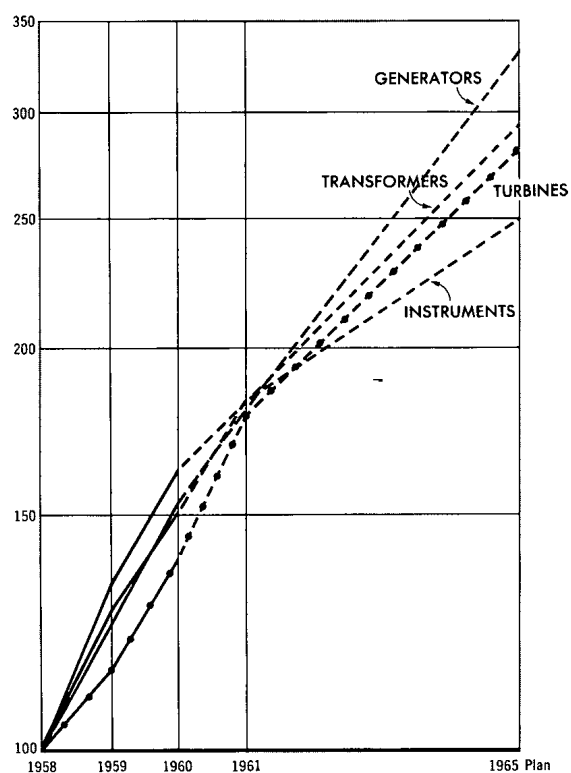
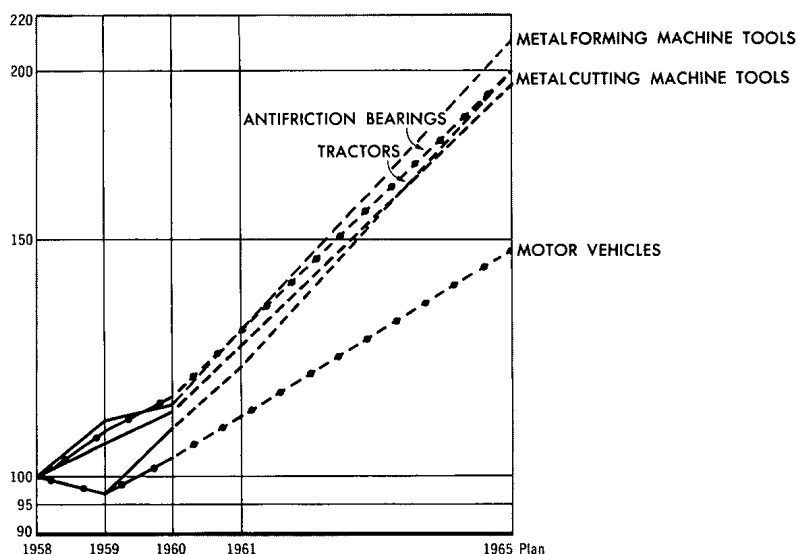
USSR: Average Annual Rates of Growth for Selected Machinery During 1959-60 and for the Seven Year Plan (1959-65)



*Using the midpoint of the range for the Seven Year Plan.

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USSR: Index of Growth in Production of Selected Machinery During the Seven Year Plan * (1959-65)



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*Using the lower limit of the range for the Seven Year Plan.

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The USSR has always espoused the standardization of designs and the maximum use of parts that are interchangeable between models. This policy permits large-scale, more economic production of components and spare parts and simplifies control of inventory in the repair shops of the end users. In 1951 when the DT-54 tractor was introduced, 75 percent of its parts were interchangeable with those of its predecessor, the Kh-STZ NATI. It is apparent, and not surprising, that many of the parts of the DT-54 are incorporated into the design of its successors, the DT-75 and the T-75. What is surprising (and criticized by Soviet economic officials) is that in these tractors (the DT-75 and the T-75) the Khar'kov Tractor Plant and the Stalingrad Tractor Plant have introduced differences in design even though the tractors are intended to perform the same tasks. This fault is likely to persist as long as both plants maintain their own design bureaus.

Standardization continues as an important feature of the motor vehicle industry. The newly designed Ural-375 truck, which is to be produced by the Ural-ZIS plant in Miass, incorporates engine, transmission, differential, universal joint, airbrake valve, and other parts that are in use on other models of trucks. Three families of gasoline engines with various cylinder arrangements (4, 6, and V-8) have been standardized for all gasoline-burning motor vehicles (except for the midget car, "Zaporozhets," which has a small air-cooled engine). The valves, pistons, connecting rods, and many other parts are interchangeable between models, regardless of the number of cylinders, within each family. In the machine tool industry, considerable success also has been achieved in designing and producing standard types of cutting heads with individual power unit drive and holding fixtures that are assembled into a wide variety of automated production lines for various special purposes.

The high degree of standardization of models of Soviet machines permits high-volume production and promotes the use of automation in production to a degree not feasible in other countries. The Soviet machine tool industry in 1960 delivered to Soviet industry more than 150 automated production lines, one of which contained 85 power units. In the machine tool industry itself a great deal more of automation and mechanization is economic, and a great deal more is employed than in the US machine tool industry. The most publicized deliveries of automated machine tool lines were those received by the motor vehicle, tractor, farm equipment, antifriction bearings, and watch industries. Because of delays in shipment of some of the components, the schedules for commissioning these lines were not adhered to in every case. Delayed shipment of one such component, control panels, held up the use of several new automated machining lines at the ZIL Motor Vehicle Plant in Moscow. These irritating deficiencies are temporary and can be ascribed, for the most part, to difficulties in coordinating production plans of all the plants contributing components to the end items. The total number of

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automated lines that the existing machine tool industry has managed to produce is quite small in comparison with the needs of the other branches of industry for such lines. In May 1961, however, a greatly increased tempo of investment in the machine tool industry was announced, as was a change in the production goal for 1965 from 200,000 to 270,000 metal-cutting machine tools.*

A program, undertaken by Soviet industry in general, to modernize 400,000 old machine tools during 1959-65 also will contribute significantly toward raising labor productivity. The machine tool branch is supplying the instructions for this modernization as well as supplying some of the replacement parts, but the work is being carried out by the plants possessing the machines. It is estimated that the goal for 1960 for modernization was achieved and that the entire program of the Seven Year Plan will be accomplished by 1965.

The Seven Year Plan has specified a raising of the quality of Soviet machine building products to the level of other advanced industrialized countries. Many new models have been designed and placed in production, particularly in the farm equipment, tractor, machine tool, electrical machinery, metallurgical equipment, motor vehicle, and locomotive branches of industry. In some cases, notably that of motor vehicles, new models and components are not yet in volume production pending the receipt of special automated production machinery. In 1960, modernized series of high-speed tractors with higher powered engines were introduced into production. The metallurgical equipment industry built the world's largest blast furnace (2,000 cubic meters) and open-hearth furnaces (600 tons**). In the field of electric power equipment the USSR produced a 320-megawatt (mw) turbogenerator set with hydrogen-cooled rotor, water-cooled stator, and supercritical steam conditions at the turbine inlet. In October 1960 the Elektrosila Plant in Leningrad completed the largest hydrogenerator in the world with a 225-mw output. New high voltage (220-kilovolt [kv] and 500-kv) transformers and small transformers with aluminum windings were placed in production.

In the construction equipment industry, however, the most modern equipment, particularly earthmoving equipment, remained in the prototype stage, in some cases because cooperating branches of industry were unable to supply new types of components, such as new industrial diesel engines. Only small progress was made in introducing newly developed chemical equipment into production, and imports were extensively employed for the acquisition of the most modern chemical plants and processes. In spite of a considerable effort in research and development in the field of instrumentation, production of obsolete industrial instruments continued throughout 1960, as the Soviet press frequently and critically noted.

* See the third footnote on p. 4, above.

** Tonnages are given in metric tons throughout this report.

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III. Individual Industrial Branches

A. Instruments*

The Soviet instruments industry had a very good production record during the first 2 years of the Seven Year Plan and is expected to exceed the original production goals set for 1965. In spite of its good record of production, however, the industry has been unable to supply either the quantity or the quality of modern instruments required by the national economy. Although Soviet design and development of instruments has continued to impress Western observers, particularly in the field of automation equipment, and although the technology of some production models of instruments has improved during the first 2 years of the plan period, production of obsolete and poor-quality instruments continues to be a major problem. In other major programs of the Seven Year Plan, such as specialization of production processes, standardization of parts and components, and mechanization and automation of production processes, the industry has made only minor advances in the first 2 years of the plan period.

The instruments industry is one of the fastest growing branches of Soviet machine building. Output is well ahead of its annual plan goals, and production in 1960 far exceeded the plan goals of the abandoned Sixth Five Year Plan. It appears likely that the industry may be able to fulfill the original goals of the Seven Year Plan as early as 1963 and, instead of producing at an annual rate of 18.5 billion to 19.2 billion rubles by 1965, may actually attain a higher level. The

* In the USSR the instrument industry is referred to as priborostroyeniye and the products of the industry as pribory i sredstva avtomatizatsii. Output of this industry includes instruments of the following types: process control devices, photographic and motion picture apparatus, time-keeping devices of all kinds, optical equipment, and computers and mathematical machines. Accounting procedures for reporting physical production of instruments apparently narrows this list by omitting value figures for output of cameras and clocks and watches, output of these items being reported separately by units. This industry apparently excludes from its list of products such categories as medical and dental instruments, machinists' precision tools, fuel dispensing meters (such as used by a gasoline filling station), and both medical and industrial X-ray equipment.

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estimated production for the industry, both actual and planned, for selected years is as follows:

<u>Year</u>	<u>Billion Rubles</u>
1958	7.39
1959	9.42
1960	11.11
1960 Plan*	7.0
1961 Plan	13.44
1965 Plan**	18.5 to 19.2

Thus it can be seen that output during 1959-60, which had an average rate of growth of about 23 percent per year, has slowed down from the 55 percent of the period 1956-58 (with 1955 as the base year) as the statistical base became increasingly large.

The rapid growth in production of instruments is believed to have been accomplished by a major allocation of investment. In the first 2 years of the plan period, an announcement of a new or converted facility has appeared more often than once per month, and this trend appeared to be continuing into 1961. In addition, a large number of the more than 250 plants of the industry have been expanded. Few of the new plants are believed to have reached full production, and construction has not even begun on some of them.

During the first 2 years of the plan period, the design of production models of Soviet instruments is believed to have improved somewhat, but, on the whole, the relative positions of the US and the USSR, with respect to the technical qualities of instruments, are estimated to be about the same as they were in 1958 (that is, the USSR is about 10 years behind the US). This evaluation is based on evidence that practical application lags far behind successful research for many categories of instruments and that output includes a significantly large volume of obsolete or poor quality instruments. The USSR, however, is making an extraordinary effort to raise the level of technology of instrumentation in industry. The USSR is already on an equal footing with the US in certain categories of instruments, and it is expected that there will be an acceleration of development, production, and application in several major areas of instrumentation, particularly in devices for process control.

* Goal of the Sixth Five Year Plan for 1960.

** Goal of the Seven Year Plan.

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The industry has made only moderate progress during the past 2 years in mechanizing its production processes, in developing standardized and interchangeable components, and in specializing plants in production of particular instruments. Only at several watch plants has automation of portions of the production process been introduced.

In spite of the fact that the USSR has a fast growing instruments industry, serious shortages in several categories of instruments have persisted through the first 2 years of the Seven Year Plan. As a consequence, the USSR has continued to import a selective list of equipment to offset some of these shortages, particularly for high-priority needs. Soviet imports of instruments rose from 134.6 million rubles in 1958 to 161.2 million rubles in 1959 and to 192.3 million rubles in 1960, an increase of 43 percent for the period 1958-60. On the other hand, exports* rose from 139.1 million rubles in 1958 to 158.9 million rubles in 1959 and to 177.8 million rubles in 1960, an increase of 28 percent for the period 1958-60. The other countries of the Sino-Soviet Bloc are the principal trading partners of the USSR, purchasing between 90 and 95 percent of Soviet exports of instruments and furnishing about 75 percent of Soviet imports of instruments. Poland, Bulgaria, Czechoslovakia, and Communist China are the major importers of Soviet instruments, and the principal suppliers of instruments are Czechoslovakia, Hungary, and East Germany (which in 1960 furnished more than one-half, by value, of all Soviet imports of instruments).

Soviet imports of instruments from the Free World are not large but are extremely important, for they represent high-priority items that either are not produced in the Bloc or are not produced in sufficient quantities to satisfy basic requirements. The official and unofficial restrictions imposed on shipments of instruments from non-Bloc countries to the USSR have been gradually eroded away in recent years, and in the future an increased volume of trade (particularly imports) can be expected.

The other countries of the Sino-Soviet Bloc are expected to continue to be the principal trading partners of the USSR. Recent agreements made by the USSR with Hungary and Czechoslovakia have committed these two Satellites to export a very large quantity of instruments to the USSR throughout the remaining years of the Seven Year Plan.

The USSR has announced its intention to import six times as many instruments in 1965 as it did in 1960. Considering the rate of growth of trade in instruments that has obtained in recent years, such a future volume of trade is entirely within the realm of possibility. The USSR

* In addition, an unknown quantity of instruments was exported as part of complete industrial plants.

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also has announced its intention to export a much larger quantity of instruments in 1965 than in 1960. In view of the anticipated needs of the domestic economy, it is questionable that this intention will be carried out fully.

B. Transformers

During the first 2 years of the Seven Year Plan, the transformer branch of the electrical equipment industry, formerly one of the most backward branches, has achieved sharp gains in output and in the introduction of new models. This new attention to an old branch of industry reflects the concern of Soviet planners with meeting the goals of the Seven Year Plan for a very substantial increase in the electrification of the USSR, not just in amounts of power generated but also in the size of area served by the distribution network. In 1960 alone, planned construction of capacity for producing transformers was greater than that constructed in the 7-year period 1952-58. In spite of the remarkable increase in production achieved in 1959 and 1960, the USSR probably will continue to be a net importer of transformers until near the end of the Seven Year Plan period.

Production of transformers in the USSR, which in 1959 had increased by 33 percent above that of 1958 (from 30,500 to 40,500 megavolt-amperes -- mva), achieved a further increase in 1960 estimated at 21.5 percent above that of 1959 (from 40,500 to an estimated total of 49,200 mva, thus surpassing the goal for 1960 (42,000 mva) of the abandoned Sixth Five Year Plan. In 1958, only 8 plants were known to be producing power transformers, but in 1960 the number had grown to 18. In addition to the new plants the expansion of a number of the older plants provided additional production floorspace. Most of the new plants, which are located at widely scattered locations throughout the USSR, are engaged in producing small and medium-size distribution transformers that are necessary in large quantities for the expansion of the power network, particularly into the rural areas. The task of producing the new 500-kv transformers for the long-distance transmission of large amounts of power was assigned to the Leningrad Elektroapparat Plant and to the Zaporozh'ye Transformer Plant, both of which used for that purpose new shops completed in 1960. The Yerevan plant also is known to have been expanded in 1960, whereas in the Minsk Electrical Engineering Plant a large amount of automated equipment and conveyors was installed.

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Estimated production of transformers, both actual and planned, for selected years is as follows:

Year	Production	
	Thousand Megavolt-Amperes	Percent of Previous Year
1958	30.5	
1959	40.5	132.8
1960	49.2*	121.5
1960 Plan**	42	
1965 Plan***	90†	

Judging from the amount of construction activity currently in progress, it seems likely that the present goal of the 1965 plan will be achieved. Old plants still are being expanded, some new plants are still under construction, and those that were finished in 1960 are still operating well below capacity. Consequently, large reserves exist for the expansion of output necessary to meet the plan goal.

In 1959 the transformer branch of the electrical equipment industry undertook two programs intended to improve the technical characteristics of Soviet transformers. One program was the development and production of new sizes of transformers, of which the 500-kv size presented the greatest challenge. The other program was the raising of the efficiency of all transformers, which until then were generally heavier, less efficient, and less adaptable to new applications than were transformers made in the industrialized countries outside the Bloc.

By February 1960, small-lot production of single-phase, 135,000-kilovolt-ampere (kva)/500-kv transformers had been started in the Zaporozh'ye Transformer Plant even though the new shop facilities were uncompleted. By the end of 1960 it is believed that production of a 275,000-kva/220-kv transformer for installation at the Bratsk GES^{††} was progressing and that designs were nearing completion for a 750,000-kva/500-kv transformer for the Krasnoyarsk GES.

* Estimated.

** Goal of the Sixth Five Year Plan for 1960.

*** Goal of the Seven Year Plan.

† Announced as approximately 2.2 times production in 1959.

†† Gidroelektricheskaya stantsiya -- hydroelectric power station.

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Little progress was made in either 1959 or 1960 in the second program -- that of improving the efficiency of Soviet transformers. In this second program the major stumbling block is the continuing lack of sufficient quantities of copper for windings and of high-quality cold-rolled transformer steel for cores. As substitutes, hot-rolled steel sheet and aluminum windings are used. The substitution of aluminum windings for copper results in increasing the size, weight, and cost of transformers without increasing their capacities. The use of hot-rolled steel rather than cold-rolled steel sheet in transformer cores decreases transformer efficiency by about 1 percent. The economic disadvantage of these old-fashioned transformers becomes more apparent when it is considered that for every 100,000 kilowatt-hours (kwh) of electrical energy that passes through them, 1,000 kwh of energy are wasted and that electrical energy must be transformed more than once after it enters the distribution system. The goals of the Seven Year Plan provide for increasing the supply of cold-rolled silicon steel substantially, and it is believed that the use of hot-rolled steel in cores can be eliminated before the end of the Seven Year Plan period. Meanwhile, cold-rolled steel and copper windings are used in the large, very-high-voltage transformers now being produced to feed the new long-distance transmission lines. Because copper will continue to be in short supply in the Sino-Soviet Bloc, the USSR, with Czechoslovakia and other countries of the European Satellites, will continue to develop and improve both distribution transformers and small power transformers that are wound with aluminum wire.

The USSR is not self-sufficient in production of transformers and supplements its output through imports from the Satellites, Yugoslavia, and Western Europe. Relatively few transformers are exported, and these are shipped mainly to the small, less industrialized countries of the Bloc. Foreign trade in transformers in 1959 and 1960 may be summarized as follows:

<u>Million Rubles</u>		
<u>Year</u>	<u>Exports</u>	<u>Imports</u>
1959	3.2	25.6
1960	1.4	49.7

In 1960, all of the imported transformers were purchased from Rumania, East Germany, Bulgaria, Czechoslovakia, Poland, France, and Yugoslavia. During 1961-65, Rumania is to ship 2 million kva of transformers to the USSR, and East Germany and Bulgaria are to increase their deliveries by an unspecified amount. In 1960, Yugoslavia shipped large quantities of transformers to the USSR and negotiated for a larger order to be shipped in 1961. The USSR gave a French firm an order for nine 525-kv transformers for delivery in 1960-61. Other large transformers are on order from Austria, Finland, and possibly Switzerland.

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C. Tractors

Following a decline in production in 1959, which apparently was planned, output in 1960, amounting to 238,500 tractors, exceeded that of 1958 by 8.6 percent. This level of output was only slightly less than the most recently announced annual plan for 1960, which resulted from an upward revision of the previous plan by 23,000 tractors. In the 3-year period just preceding the Seven Year Plan period (1956, 1957, and 1958), production of tractors had been growing by 20,000 to 30,000 units per year. The leveling off in this pattern of growth in 1959, according to the official Soviet explanation, resulted from the disruptions that accompanied the introduction of major modifications to the tractors in production. Apparently only a very slight increase above production in 1959 was originally planned for 1960 (another year of model change), but during the course of the year, according to an official announcement, it was found possible to achieve further increases in production without new construction. Estimated production of tractors, both actual and planned, for selected years is as follows:

<u>Year</u>	<u>Thousand Units</u>
1958	219.7
1959	213.5
1960	238.5
1961 Plan	268.0
Original 1965 Plan	375
Revised 1965 Plan	440

During 1960 the Seven Year Plan goal for 1965 was raised for the second time and production of tractors about twice that of 1958 was scheduled. The attainment of this goal of nearly 440,000 units will require an expansion of production at an average annual rate of 13 percent during 1961-65. The change in production goals undoubtedly is related to the change in the plan for delivering tractors to agriculture. This plan stipulates that agriculture will receive 1.5 million tractors in the last 5 years of the Seven Year Plan period, a large increase above that of the earlier provision for the delivery of 1,240,000 tractors in the entire 7-year period. In fact, 298,000 tractors had been delivered in 1959 and 1960 before the change was announced. If the planning authorities seriously intended to assure the delivery to agriculture of this larger number of tractors, the plan to increase production to more than 400,000 tractors in 1965 is reasonable (even granted that agriculture is to receive a larger share of the total production in the latter

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part of the Seven Year Plan period). Furthermore, it seems likely that the necessary resources will be allocated to carry out the measures on which an increase in the capacity of the industry is based. As a corollary to the intention to deliver a larger portion of the total output of tractors to agriculture in the later years of the Seven Year Plan period (estimated at 80 percent of the total output in 1965 compared with 65 percent in 1960), it is expected that most of the increases in production will be in the small and medium-size wheeled types of tractors that Soviet agriculture has been favoring more and more in recent years.* Thus percentage increases in production based on units produced do not reflect the same percentage increase in production activity that would be associated with production of an equal number of large tracklaying tractors for the logging or construction industry.

It is not to be expected that production will rise smoothly throughout the last 5 years of the Seven Year Plan period. The measures to be taken to increase production will tend to add capacity intermittently and in sizable blocks. A considerable amount of new production floorspace is being constructed at the existing plants. The Stalingrad Tractor Plant is being enlarged greatly, the Khar'kov and Minsk Tractor Plants are receiving significant additions, and the Lipetsk Tractor Plant is receiving a new assembly shop. Moreover, the Kishinev Motor Vehicle Parts Plant is being converted into a tractor assembly plant. The Tashkent Irrigation Machinery Plant was converted to the Uzbek Tractor Assembly Plant in Tashkent in 1960. The recently constructed Altay Engine Plant in Barnaul, which before 1961 had produced only a few diesel engines for grain combines, is to become one of the largest producers of engines for combines and tractors in the USSR in the remaining years of the Seven Year Plan. The Serp i Molot Engine Plant in Khar'kov is now delivering engines to the Stalingrad Tractor Plant and eventually is to produce all the engines needed by the Khar'kov Tractor Plant, thus freeing production floorspace in the latter plant for increased production of tractors.

Some of the increases in output to be drawn from improved efficiency also will appear intermittently. As automatic lines are installed, for example, production will increase sharply. The increases in production derived from the effects of specialization will appear more gradually, as, for example, when the Khar'kov Tractor Plant transfers production of engines to the Serp i Molot Engine Plant (as distinct from the increases obtained from the floorspace released at Khar'kov Tractor Plant in the process). The production increases achieved in 1960 seem to have resulted primarily from improvements in the equipment and methods employed in the plants.

* Wheeled types of tractors constituted 49 percent of the total production in 1960 and are to constitute 70 percent in 1965.

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In general, the modifications introduced into production models in 1960 and the new designs that were to be introduced in 1961 and in the remaining years of the Seven Year Plan period represent significant contributions to efficiency in the use of tractors in many agricultural and industrial activities. The emphasis of design has centered on achieving greater power and productivity per unit of weight and more versatility for greater adaptation to specific jobs. The Khar'kov Tractor Plant replaced the track-laying DT-54 tractor with the T-75, a modified version of the DT-54A, that has increased speed and horsepower. The Stalingrad Tractor Plant was planning to convert to the DT-75, a T-75 type but with an engine of different design, in September 1961. The Minsk Tractor Plant introduced the MTZ-5MS and the MTZ-5LS, faster and more powerful wheeled types, as replacements for the MTZ-5M and the MTZ-5L and developed the MTZ-50 for production in 1961. The Vladimir Tractor Plant introduced a new faster and slightly more powerful wheeled type of tractor in 1960 but produced very few of them by the end of the year. At Lipetsk, which has always produced track-laying tractors, work progressed on a new assembly shop for manufacturing a new type of high-speed wheeled tractor, but as of February 1961 the building was still not ready for serial production. At the Chelyabinsk Tractor Plant, near the end of 1960, the first models of the T-130, with greater power and higher speed than the S-100 track-laying tractor that they were to replace in production during 1961, were beginning to come off the assembly line.

The Soviet policy of standardizing designs continued to permeate design and development activities in the tractor industry in 1960 and is evident in the models of engines developed by the Serp i Molot Engine Plant in Khar'kov for installation in tractors and combines. The Altay Engine Plant is to produce the same family of engines for tractors and combines as the Serp i Molot Engine Plant, and between them these two plants eventually probably will supply all the engines needed by the Khar'kov, Stalingrad, and Altay Tractor Plants. Surprisingly the DT-75 tractor to be produced this year at the Stalingrad Tractor Plant and the T-75 now in production at the Khar'kov Tractor Plant embody dissimilarities in design although they have identical operating characteristics. Soviet economic officials have taken disparaging note of this violation of policy, which they ascribe to arrogance at the Stalingrad Tractor Plant.

Most of the tractors produced in the USSR are delivered to domestic industry and agriculture, exports not having exceeded 8,500 units in any year during 1955-58. In 1959 and 1960, however, as a result of the newly intensified drive for the collectivization of agriculture in the European Satellites, exports to that area were three times the annual average for 1955-58 of 4,000 tractors. In spite of the fact that five of the Satellites produce tractors for export, every one of them imports tractors from the USSR to complement the limited number of types and sizes

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that are available from domestic production. By 1960, collectivization of agriculture in East Germany, Czechoslovakia, Hungary, and Bulgaria approached 100 percent. The need for intensified mechanization in order to obtain savings in manpower from collectivized agriculture will keep pressure on the USSR to supply the Satellites for some years to come. The USSR imports tractors only for study and relies on its own production to satisfy its needs.

D. Hydrogenerators and Turbogenerators

The branch of the Soviet electrical equipment industry producing hydrogenerators and turbogenerators failed to reach the planned production goals for 1960 but nevertheless achieved an output that is outstanding when compared with the results of 1958 or 1959. The estimated production of this branch of the electrical equipment industry, both actual and planned, for selected years is as follows:

<u>Year</u>	<u>Thousand Megawatts</u>
1958	5.2
1959	6.5
1960	7.9
1961 Plan	N.A.
1965 Plan	17.5 to 18.4

In view of the relatively small amount of new construction known to be in process at the four plants in which production of large electric power generators is concentrated, it is expected that the industry will have grave difficulty in achieving by 1965 a planned production that is to be more than twice the output in 1960. Known construction during the remaining years of the Seven Year Plan consists of a new building of 250,000 square feet that was under construction in the Khar'kov Heavy Electrical Machinery Plant in 1960 and the completion by 1965 of the Novosibirsk Turbogenerator Plant. No plans for expansion of the Ural Elektroapparat Plant in Sverdlovsk or the Elektrosila Plant in Leningrad are known, although the plan for 1961 stipulated surprisingly large increases in production of generators in the Elektrosila plant that could be obtained only by discontinuing production of other electrical products. Specifically the 1961 plan for the Elektrosila plant required an increase of 57 percent in production of hydrogenerators and 26 percent in production of turbogenerators above the level of 1960. This

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single plant in 1960 produced most of the hydrogenerators and about one-half of the turbogenerators (measured in megawatts*) produced in the USSR. It seems evident that a considerable part of the increases in production of generators in 1961 and in the remaining years of the Seven Year Plan period will be achieved by producing units of larger capacity in plant space previously used to produce medium-size generators.

In the event that the USSR should fail to achieve the goal of the Seven Year Plan for production and installation of new generating capacity, it would not necessarily fail to reach the 1965 goal for generating electricity. Enough reserve generating capacity has been planned to compensate for a considerable shortfall in installation. Old power stations that are uneconomical in the consumption of fuel would have to be kept in base load service, however, and could not be relegated to standby or peaking service in accordance with the plan.

The desire to install the most economical power stations in terms of pounds of fuel per kilowatt of energy plus the decision to commission large individual blocks of generating capacity in localities where cheap fuel is plentiful and to transmit it to centers of consumption over very-high-voltage, long-distance transmission lines has strongly influenced Soviet policies of design and development of generators. To achieve this end, a great deal of attention has been given to the cooling and insulating of generators -- the two most difficult problems that hinder production of very large generators. The Khar'kov and Leningrad plants have been working on the development of generators of 200 mw and larger since 1956. At the end of 1959 the Khar'kov plant produced its first 200-mw turbogenerator, and by March 1961 it had produced a total of six. This plant also began production of a 300-mw turbogenerator in 1960 and expected to complete it by October 1961. All of these units employ hydrogen cooling of the rotor and water cooling of the stator. By the end of 1960 the Leningrad plant had completed a similarly cooled generator with a rating of 320 mw. The plan for the installation of new generators during the Seven Year Plan period specifies units rated at 100, 150, 200, and 300 mw. The Leningrad plant, however, has undertaken the design of turbogenerators rated at 600 and 850 mw. The success of this design will rest on the experience gained in producing 320-mw units. These very large generators will be in the process of manufacture in the Seven Year Plan period but are not scheduled for installation until a later date. The Novosibirsk plant also has been working on the design of a 320-mw turbogenerator that it will produce during 1962-63.

* Production is measured in generating capacity.

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In October 1960 the Leningrad plant completed the first Soviet hydrogenerator rated at 225 mw, the largest generator of its kind so far produced in the world. The Sverdlovsk plant produced a 150-mw hydro-generator for Communist China in 1960 and is now designing a 500-mw giant hydrogenerator, 10 of which will be required for the Krasnoyarsk GES. The Leningrad plant also is designing a 500-mw hydrogenerator for the Krasnoyarsk GES. Presumably both plants will produce these generators, each according to its own design.

Compared with the US and the industrialized countries of Western Europe, the USSR leads in production of hydrogenerators when physical size is the basis for comparison. The USSR lags behind the US, however, in production of large gas-cooled and liquid-cooled turbogenerators and is only starting production of generators in sizes that have been in operation in the US for as long as 10 years. The basic problem in designing generators of large capacity (300 mw and above) is to keep the size down so that the rotor can withstand the dynamic forces imposed on it. The capacity of modern generators has been increased with disproportionately small increases of size by providing improved insulation and cooling. Improved insulation is required for higher voltage at higher temperatures, and improved cooling is required to carry off the heat generated by the higher flow of current. By 1960 the Soviet engineers apparently solved the cooling problem. They are still about 10 years behind the US in the use of insulating materials, simply because they do not have adequate supplies of special composition varnishes, low-pressure polyethylene, butyl rubber, silicon-organic rubber, silicon-organic varnish, epoxy resins, and frostproof materials. The Soviet engineers are aware of these deficiencies and, with the help of their chemical industry, eventually will correct them.

Foreign trade in hydrogenerators and turbogenerators in 1960 was limited to exports to a few underdeveloped countries of the Sino-Soviet Bloc and the Free World, notably Communist China, Rumania, Bulgaria, and India, and although it is believed that large shipments have been made occasionally, little more is known about the volume of exports in 1960. Recent announcements indicate that turbines and generators with a total capacity of 1,500 mw were to be exported in 1961.

E. Motor Vehicles

In 1960 the Soviet motor vehicle industry produced 523,600 motor vehicles, a volume of output somewhat more than the 495,000 produced in 1959 and the 511,100 produced in 1958. Little significance with respect to progress in the industry can be attached to the increased production in 1960, which amounts to less than 6 percent above that of 1959 (a year of decreased production) and only 2.5 percent above that of 1958. The decrease in production in 1959 was planned, but although some official

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sources ascribe it to dislocation in production processes caused by changes in models, [] attributes it to shortages of rolled steel. The latter explanation is consistent with the known persistent shortage of sheet steel, particularly cold-rolled steel, which is general in the Sino-Soviet Bloc.

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Moreover, although the Seven Year Plan requires production of at least 750,000 motor vehicles in 1965, there are good reasons, aside from shortages of supplies, that would lead to only small increases in output in 1959 and 1960. The explanation for the present low rate of growth in output can be found in an examination of the status of the major transformations that are taking place in the industry in accordance with the provisions of the Seven Year Plan.

Just before the start of the Seven Year Plan in 1959, the motor vehicle industry was still organized very much as it was when it emerged from the Fourth Five Year Plan (1946-50), with most of its product issuing from two major plants, the Likhachev Motor Vehicle Plant in Moscow (ZIL) and the Gor'kiy Motor Vehicle Plant in Gor'kiy (GAZ). These plants were, and still are, highly integrated production complexes that manufacture all their own components except for such highly specialized items as glass, tires, fuel systems, electrical equipment, and ignition equipment. A number of small plants accounted for the minor portion of the industry's output, and although none was so self-sufficient as ZIL and GAZ, some of them produced, in varying degrees, many components that should have been purchased from vendors. Other irrational activity, such as production of small quantities of heavy trucks at both the Yaroslavl' and the Minsk Motor Vehicle Plants and production of both 7-ton and 25-ton trucks at the Minsk Motor Vehicle Plant, either prevented realization of the economies of larger scale production or required processing parts in shops and on machines that were not especially well adapted to making those parts.

A primary aim of the Seven Year Plan for the motor vehicle industry is to increase the variety of models in production in order to meet more effectively the changed demands of the Soviet economy. The previous policy of the USSR was to mass-produce a minimum number of models of trucks, buses, and cars, with the goal of building up the park as rapidly as possible. Virtually no major model changes were effected during 1948-58. Not only were the models becoming increasingly obsolete but also there has been a greater awareness since 1956 of the inadequacy of the limited variety of vehicles being produced. The USSR in 1958 was producing no trucks with a capacity of less than 2 to 2-1/2 tons in spite of the growing need for smaller "pick-up" and delivery vehicles. The industry also was not producing adequate numbers or types of tractor-trailer units for hauling large cargo loads. Only two sizes of city buses were in production at the start of the Seven Year Plan, and only three sizes of passenger cars were mass-produced. During the Seven Year Plan the industry is expanding the

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variety of trucks in production to include 3/4-ton "pick-up" trucks, 40-ton dump trucks, and a number of specialized vehicles, including several types of truck-tractors for hauling semitrailers. New buses will range in size from 8-passenger taxis to 100-passenger city buses that are intended to accommodate rush-hour crowds, and the range of products in the field of passenger cars is being extended to include a new midget car.

The Seven Year Plan provides for output in 1965 to be about 1.5 to 1.7 times that of 1958 and for an increase in labor productivity of 45 to 50 percent. It is implicit in this provision that most of the increase in capacity is to come from improvements in equipment and methods. The implication is borne out in the details of the plans for the reequipping of the industry with new automatic machines, automated production lines, and miles of conveyors, which are to be installed in forge shops, foundries, sheet metal stamping shops, machine shops, and assembly buildings. Much of this equipment will consist of single-purpose machinery, designed to produce a single part in large volume and either not convertible or not easily convertible to production of a part of different design. It seems evident that the introduction of completely modernized models of motor vehicles is dependent on the delivery of this machinery.

The development and delivery of the new machinery was hardly started in 1959 and 1960, and, considering that it represents a major task of the machine tool industry during the period of the Seven Year Plan, several more years likely will pass before the motor vehicle industry is completely equipped for high-volume production of the new models of the commonest trucks. When such equipping occurs, it is expected that production will rise rapidly. In the Soviet motor vehicle industry, parts and components are modernized as new specialized production equipment becomes available. This process often enough results in production of transitional models of vehicles containing some new and some obsolescent assemblies. In September 1960, for example, ZIL began to produce the ZIL-164A, which is basically a ZIL-164 with some of the modernized assemblies of the advanced model ZIL-130. Notably absent is the new V-8 engine of the ZIL-130 for which complete tooling had not yet been received.

Meanwhile, progress is being made in the specialization of plants for production of certain classes of vehicles. The industry advanced further in this program in 1960 than in any other year. ZIL ceased production of buses and bicycles and made the space formerly used for this purpose available for the installation of automated equipment for producing trucks. The Likino Bus Plant had been established in 1959 to specialize in production of large city buses that formerly were produced by ZIL. The Yaroslavl' Motor Vehicle Plant (YaAZ) was phased out of

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production of 10-ton and 12-ton trucks in order to devote all its facilities to production of diesel engines for the motor vehicle industry. The Kremenchug Motor Vehicle Plant (formerly a producer of a now discontinued model of a corn harvesting machine), within a year after beginning production of 10-ton and 12-ton trucks, became the sole producer of them in the USSR. Another former agricultural machinery plant, the Kommunar plant in Zaporozh'ye, became the Zaporozh'ye Motor Vehicle Plant with the specialized assignment of producing the "Zaporozhets," a new midget passenger car, equivalent in size and weight to the Italian Fiat-600 or the West German NSU Prinz. Not only was the main assembly building still under construction when production began in 1960, but also many of the plant's vendors failed to meet the delivery schedules or match the specifications for components. Production of engines for the "Zaporozhets" has been assigned to the Melitopol' Diesel Engine Plant imeni Kirov, which in 1960 had not yet been relieved from producing small marine and industrial diesel engines and thus experienced difficulty in organizing production of "Zaporozhets" engines. A third plant specializing in production of engines for the motor vehicle industry (in addition to YaAZ and Melitopol') is the Zavolzh'ye Engine Plant near Gor'kiy, which is to be the major producer of gasoline engines for passenger cars and light and medium trucks and buses. The Zavolzh'ye plant eventually is to produce all the engines for trucks and passenger cars built at GAZ and at the Ul'yanovsk Automobile Plant and will produce engines for some of the trucks produced at ZIL. ZIL, however, is installing new automated machinery for producing V-8 engines, and it seems likely that it eventually will be the only vehicle production facility which also will be producing engines.

The Ural-ZIS plant in Miass, which has been producing the Ural-ZIS-355M, a ZIL type of 4-ton truck only slightly altered in appearance from the ZIL-164, is to discontinue this production and begin production of the Ural-375. The latter is a 5-ton, 6-by-6 highly mobile truck (8 tons on the highway), equipped with a number of features usually associated with purely military trucks, such as large-diameter high-flotation tires, provision for deflating and inflating tires while in motion, and a carburetor air intake at the level of the cab roof to facilitate deep fording operations. A few of these trucks probably were produced at the end of 1960 in time for the anniversary of the October Revolution, and perhaps a few more were made in 1961. Because the new ZIL V-8 engine is to be installed in the Ural-375, serial production of this truck will be delayed pending the tooling of the ZIL plant for mass production of the engine.

Standardizing parts and making them common to more than one model of truck have always been features of the Soviet motor vehicle industry. That these features are still present is evident from an examination of the new models being introduced during the Seven Year Plan period. Not only are components being unified between the new models, but also, wherever possible, parts that have proved their worth in service in discontinued vehicles are specified in the design of new vehicles.

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Trade in motor vehicles for the most part is with the Sino-Soviet Bloc, as is shown in the following tabulation of data for 1960 (the last year for which data are available):

	Thousand Units		
	<u>Trucks and Buses</u>	<u>Passenger Cars</u>	<u>Total Vehicles</u>
Exports			
To the Bloc	21.4	16.0	37.4
To industrialized non-Bloc countries	0	8.8	8.8
To the underdeveloped countries of the Free World	2.9	5.3	8.2
To unknown destinations	0.1	0.1	0.2
Total	<u>24.4</u>	<u>30.2</u>	<u>54.6</u>
Imports	3.3	3.0	6.3

The only vehicles imported in significant volume are station wagons and heavy diesel trucks from Czechoslovakia and buses from Hungary. Similar vehicles are produced in the USSR, and their import serves only to supplement domestic production. Motor vehicles imported from non-Bloc countries usually are single items purchased for study and adaptation. Exports, which during 1960 constituted about 10 percent of motor vehicles produced, are dispatched primarily to the other Bloc countries. During 1959-60 the USSR continued its practice of exporting military vehicles to a number of the more unstable underdeveloped countries. Soviet exports of passenger automobiles to the industrial West serve as an opportunity for political propaganda and as a source of hard currency. In the first 2 years of the plan period, the USSR has had only limited success in such operations, primarily because, aside from the price, Soviet vehicles do not compare favorably with Western products. Even in the underdeveloped countries the USSR has had only partial success in exporting nonmilitary motor vehicles, simply because the advantageous prices and terms offered by the USSR are offset by inferior quality, poor service facilities, and a shortage of spare parts.

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F. Antifriction Bearings*

The USSR produced 369.7 million bearings in 1960, an increase of 5.4 percent compared with 1959. During 1959-60, the first 2 years of the Seven Year Plan, the average annual increase in production of bearings amounted to 6.6 percent. The estimated production of bearings, both actual and planned, for selected years is as follows:

<u>Year</u>	<u>Million Units</u>
1958	325.1
1959	350.7
1960	369.7
1965 Plan**	650

In 1960, the last year for which data are available, the USSR exported, primarily to other countries of the Sino-Soviet Bloc, 11.7 million bearings, equal to about 3 percent of the total production. Imports, amounting to less than 0.1 percent of the total domestic output, consisted for the most part of special types purchased from the industrialized countries of the West.

The planned doubling of production during the Seven Year Plan period, which will require an average annual rate of growth during 1961-65 of about 12 percent, is to be accomplished principally by the installation of a large amount of modern production equipment. A relatively smaller part of the increase in production is to come from newly constructed facilities. The slow progress in these two programs so far bodes ill for the realization of the plan goals for 1965.

In January 1959 the Presidium of the Academy of Sciences, USSR, provided for a joint laboratory to consider scientific, technological, and economic problems associated with the automated production of bearings. The laboratory was to be located on the grounds of the State Bearings Plant in Moscow and to be staffed by professional members of a number of 50X1 scientific and technical institutes.*** Eighteen months later (in mid-1960) the laboratory still was not in existence, and several of the institutes were ignoring the directive while others gave only token support.

* Antifriction bearings include ball, roller, and needle bearings and their component parts. Plain or sleeve bearings are not included. Throughout this section the term bearings is used to refer to antifriction bearings.

** Lower limit of the goal of the Seven Year Plan.

*** The Institute of Automation and Telemechanics, the Institute of Machine Engineering, the Mathematical Institute imeni V.A. Steklov, the Institute of Economics, and the Institute of Electronic Control Machines.

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Meanwhile, in March 1960, more than a year after the start of the Seven Year Plan, a Department of Plant Reconstruction and Automation Technological Planning was established at State Bearings Plant [] By June 1960 this department had worked out with the State Institute for the Planning of Industrial Automation a plan for the reconstruction and automation of the plant. By the end of July the institute had not yet prepared the drawings for the first building in which universal joint bearings are to be produced by automated production lines. Also, at that time, only the universal joint bearing shop had been included in the 1961 State Plan by the State Planning Commission, and nothing had been done as far as the rest of the automatic shops were concerned.

50X1

The fact that little progress was made in 1960 toward the automation goals of State Bearings Plant [] is very significant for the industry as a whole because this largest of Soviet bearings plants has been selected to serve as a model for the industry in the introduction of automation and, by the end of the Seven Year Plan, is to produce 80 percent of its product on automated equipment.

50X1

In other plants of the industry, some new automated or improved machinery was installed. State Bearings Plant [] in Minsk connected a number of existing machines with new materials-handling devices to form an automatic line for machining outer races. New automatic devices also were installed in the washing and packaging departments. At State Bearings Plant [] in Kuybyshev a little progress also was made toward the 1965 goal of producing 50 percent of its product on automatic production lines.

50X1

50X1

The bearings plant now under construction at Volzhskiy near Stalingrad is the only known new plant intended to be added during the Seven Year Plan period. When completed, the plant is to be the largest in the industry, exceeding even the capacity of State Bearings Plant [] in Moscow. Construction, which started late in 1959, was delayed by late deliveries of materials, and partial production, which should have started in 1960, was postponed until an unspecified date early in 1961. Other additions to the production area are the new shops for railroad car bearings being constructed at State Bearings Plant [] in Tomsk and State Bearings Plant [] in Saratov and the above-mentioned shop for universal joint bearings being constructed in 1961 at State Bearings Plant [] in Moscow.

50X1

50X1

50X1

50X1

An issue that has appeared prominently in the Soviet discussions of faults in the administration of the bearings industry has been that of planning. The strong trend toward expensive automation in the industry is justified by the ample opportunity for plants to specialize in production of certain types and sizes of bearings and to produce them in very large volume. There have been a number of incidents of blundering

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on the part of responsible planning officials in giving production assignments to the various plants, with disadvantageous results for productivity rates and costs in the industry. In one case, existing automated production lines are running at rates well below capacity, while other nonautomated facilities in other plants are producing the same bearings at higher unit costs. In another case, State Bearings Plant [] in Saratov had prepared plans for the automated production of a particular bearing, which it had been making for years, at a time when part of this production assignment was transferred to Izhevsk. Saratov was then asked to substitute production of another type of bearing to occupy the resulting unused capacity. State Bearings Plant [] not only found it unprofitable to install the automatic lines, but, with production of two types in small series rather than one type in mass production, was unable to make profitable use of individual special automatic machine tools. 50X1

In some instances, incomplete planning of automation is delaying its effective installation. For example, only the lathe units of a line to be installed at State Bearings Plant [] were produced and tested, and they cannot be used effectively, because the forging equipment has not been designed and ordinary forgings do not meet the high standards on tolerances necessary to feed this line. 50X1

That production of bearings in the USSR is generally adequate for domestic requirements is evident in the fact that the USSR is a net exporter of bearings. From time to time, shortages of particular types and sizes develop at the point of consumption and engender delays in the delivery of finished machinery. Such a shortage developed late in 1960. At that time, high-precision spherical and tapered bearings were lacking for completing the assembly of machine tools, mining machinery, metallurgical equipment, and transport equipment. These shortages result from poor planning of distribution and frequently involve bearings that the distributing agencies are hoarding in their reserves. Another factor contributing to temporary shortages in supply is the general dereliction of consumers in the timely placing of orders. The placing of orders just before the delivery date is said to have made late delivery the rule rather than the exception.

Since 1958 the bearings research institutes for the USSR, East Germany, and Czechoslovakia have been working on the priority project of developing "superprecision" miniature bearings for the Soviet Air Force. During 1959 and 1960, considerable progress was achieved, and State Bearings Plant [] in Kuybyshev, which contains a special section for production of miniature bearings, succeeded in producing bearings down to a bore diameter of 0.7 mm, and possibly as small as 0.5 mm, with the retention of high-precision qualities. Production of miniature bearings at this plant reportedly reached a rate of 100,000 per month in 1960. An increase in production of these bearings depends on the installation of new types of imported or domestically produced grinding machines. 50X1

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G. Agricultural Machinery

Production of agricultural machinery in 1960 amounted to 7.3 billion rubles, a 14-percent increase above the 6.4 billion rubles produced in 1959. This increase probably represents little growth in the physical facilities of the industry, being largely the result of improved efficiency within plants specializing in agricultural machinery. Both the value of the total production of agricultural machinery and the volume of individual major types, both actual and planned, for selected years are as follows:

<u>Item</u>	<u>1958</u>	<u>1959</u>	<u>1960</u>	<u>1961 Plan</u>	<u>1965 Plan*</u>
<hr/> Billion Rubles <hr/>					
All types of agricultural machinery	8.5	6.4	7.3	9.0	N.A.
<hr/> Thousand Units <hr/>					
Grain combines	65.0	54.7	59.0	76.5	138.2**
Ensilage combines	38.1	12.6	15.0	30.0***	60.0
Cotton pickers	Negl. [†]	0.5	3.2	5.0 ^{††}	15 to 20
Tractor plows	164.0	154.9	148.4	N.A.	157
Tractor drills	218.3	136.7	123.0	N.A.	140.5
Tractor cultivators	180.3	121.5	83.5	N.A.	100

* These figures are based on analysis of official statements concerning plan revisions. The statements are expressed, in some cases, in terms of announced production in earlier years.

** The original plan called for delivery of 400,000 grain combines during 1959-65. The plan was revised in mid-1960 to 540,000 units and revised again at the end of 1960 to 500,000 units during 1961-65 alone, or a total for the period, including the 107,000 actually delivered to the agricultural sector in 1959-60, of 607,000 units.

*** An increase of 5,000 units above the 1961 Plan that was announced in December 1960.

† In 1951, 9,840 cotton pickers were produced, but production has dropped steadily since that date. Finally, in 1958, regular production stopped altogether while a more satisfactory machine was being developed.

†† The 1962 Plan calls for 10,000 units.

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Officially the decline in production in 1959 and the inability of the industry by the end of 1960 to regain the level of output of 1958 are ascribed to disruptions in production that resulted from the introduction of new models in place of the outmoded models which the industry, by 1958, had become adept at making. Certainly this explanation is acceptable for the reduction in output that was experienced by the plants of the agricultural machine building industry. In large measure, however, production fell in 1958 and 1959 from the high of 1957 (10 billion rubles) because of the phasing out of agricultural machine building in many plants the primary mission of which was the manufacture of other sorts of machinery but which had been pressed into the service of the agricultural machine building industry during the period when the cultivated area was being rapidly expanded and when mechanization of production of fodder and other crops was being intensified. The recovery in output achieved in 1960 reportedly resulted not from the construction of new production floorspace but from improvements in methods, from the development of specialization, and from the modernization of the stock of production equipment. These official reasons for increased production in 1960 are correct in the main, but they ignore the fact that production of agricultural machinery in nonagricultural machinery plants was again on the rise. From the increase in 1961 of the farming out of orders to plants not in the agricultural equipment industry and from the increase of 13 billion rubles in the industry's total production assignment (announced in 1960) for the remaining years of the Seven Year Plan, it appears that this interim measure may continue for several years until planned new construction and reequipment of the industry is completed.

In 1960, as in 1959, the agricultural machinery industry introduced a number of new models. Only one-half of the 403 models in production in 1960 had been produced before 1959, and the number of outmoded models in the product assortment of the industry will continue to diminish in accordance with the scheduled creation of 350 new designs of farm machinery during 1960-63. Emphasis is being shifted from drawn implements to implements that can be tractor-mounted and also to implements that will work satisfactorily with the new family of high-speed tractors. Although a great variety of machinery has been made available, severe shortages persist in the number of types of machines that are made for such tasks as grain cleaning; loading and unloading farm products; transport on the farm; harvesting hay and cotton; work in orchards and vineyards; and cultivating and harvesting corn, sugar beets, and potatoes.

Plans for expanding production include plans for the construction of an unknown number of new agricultural machinery plants and for the completion of the Kazakh Agricultural Machinery Plant in Tselinograd (formerly Akmolinsk) and the huge 400-acre Pavlodar Combine Plant. During the Seven Year Plan, however, it also is intended that the productivity of labor will increase by about 70 percent, in large measure through the introduction of automatic machines and automated production lines. The agricultural machinery and tractor industries combined will receive a total

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of 500 automated lines. Some progress has already been made in the installation of automatic production line equipment, but it is apparent that the bulk of such machinery will not be available to the industry until the later years of the Seven Year Plan period. Furthermore, it seems likely that of the 500 automatic production lines mentioned above, the agricultural machinery industry will receive the smaller portion and the tractor industry the larger portion. In view of the very large assortment in which agricultural equipment must be produced (to carry out a large variety of farm tasks), which tends to reduce the volume of output of any item, there are, compared with the tractor industry, relatively fewer possibilities for cost savings from automation.

Both the large assortment of both old and new agricultural machinery in the inventory and the pronounced tendency of agricultural machinery to wear rapidly in service place a severe demand on the industry for spare parts, a demand that could no more be satisfied in 1960 than in any previous year. For a very few standardized parts, common to a number of implements, production in large volume has been obtained through automated production lines. Such lines for producing plowshares, rake teeth, and binder chain links were installed in 1959 and 1960.

During the first 2 years of the Seven Year Plan, Soviet exports of agricultural machinery increased sharply, from 74 million rubles in 1958 to 115 million rubles in 1959 and to about 170 million rubles in 1960. This increase came as the result of Soviet support for the expansion of collectivized sectors of agriculture in the Sino-Soviet Bloc, principally in the European Satellites. The increase in exports during 1959-60 is expected to be a temporary situation, with subsequent reduction in exports as the needs of the European Satellites are reduced. The industry will continue to be oriented domestically during the remainder of the plan period. Although the USSR annually imports a limited quantity of agricultural machinery, these imports are largely threshing machines purchased from Bulgaria and East Germany to supplement domestic production. Otherwise, imports are mostly items of machinery needed for study.

H. Metallurgical Equipment*

In 1960 the USSR produced 217,800 tons of metallurgical equipment, 8.6 percent more than were produced in 1959. Of the 217,800 tons, an

* Soviet statistics on production of metallurgical equipment include production of a portion of the equipment required in both the ferrous and the nonferrous metals industries, although by far the larger proportion of such equipment is for ferrous metallurgy. The statistics, which are expressed in terms of the weight of equipment produced, exclude output of equipment for ore mines and concentrating plants. Although the data include production of part of the equipment installed in other segments of the metallurgical industries, the major portion of the total production of metallurgical equipment is rolling mill and finishing line equipment.

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estimated total of 120,000 tons was rolling mill equipment, output of which increased in 1960 by 17.3 percent above that of the previous year, thus nearly matching the 17.7-percent increase achieved in the first year of the Seven Year Plan. These successive gains in production reversed a trend of declining production of rolling mill equipment in the years immediately preceding the current plan period. Production of rolling mill equipment in 1960 actually was only 7.8 percent higher than that of the previous peak of 111,300 tons achieved in 1956.

The estimated production of all metallurgical equipment and rolling mill equipment, both actual and planned, for selected years is as follows:

Item	Thousand Tons					
	1958	1959	1960	Sixth Five Year Plan Goal for 1960	1961 Plan	1965 Plan
Metallurgical equipment	176.1	200.5	217.8	280	N.A.	305
Of which:						
Rolling mill equipment	86.9	102.3	120	197.5	150	200 to 220

Although no specific goal has been announced officially for production of all metallurgical equipment in 1965, one authoritative Soviet publication indicates that planned aggregate output during the Seven Year Plan is 1,724,000 tons. Fulfillment of this goal for aggregate production would require a uniform rate of growth for the years 1961-65 of the plan period of approximately 7 percent, or a production level of about 305,000 tons by 1965. This rate of growth actually is less than the percentage increases of 13.9 and 8.6 achieved in production of metallurgical equipment in 1959 and 1960, respectively. Of the total output during 1959-65, production of rolling mill equipment will account for 1,144,000 tons, which is 75 percent larger than in 1952-58. Planned production of rolling mill equipment would represent 66.4 percent of the total compared with 58.8 percent in 1952-58.

It should be noted that the achievement of the goal for aggregate production for rolling mill equipment imposes a more formidable task than does the goal of the Seven Year Plan for production in 1965 of 200,000 to 220,000 tons. To reach the lower range of the goal for 1965, an average

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annual rate of growth of about 11 percent is required during the remainder of the plan period. Attainment of this level of output appears feasible for 1965, although it will be dependent on the success of programs for adding new capacity, primarily at existing machine building plants; improving production techniques; and overcoming existing shortcomings in the organization of production by such measures as greater specialization among major producing plants and improved coordination of design and production activities. Evidence exists of progress in these directions. On the other hand, a uniform annual percentage increase in output during the years 1961-65, which would be adequate to reach the 1965 Plan goal, would not yield the total amount of rolling mill equipment that must be produced during that period in order to achieve the aggregate goal of the Seven Year Plan. To achieve the goal for aggregate production, even if the 1961 plan goal of 150,000 tons is fulfilled, it would be necessary to achieve an annual output averaging 193,000 tons during 1962-65.

As a result of the increase in production of rolling mill equipment in 1960, the relative share of this equipment in the total production of metallurgical equipment increased from 51 to 55 percent but was still considerably short of the average of more than 66 percent required during the Seven Year Plan. The increase in output of rolling mill equipment in 1960 contributed to the completion of rolling mill projects that provided the iron and steel industry with an estimated total of 4.1 million tons of new rolled steel capacity. Among the major rolling mill projects were three continuous hot sheet rolling mills, one of which is alleged to be the widest in the world, and a large cold rolling mill. Another major project was the completion of a continuous casting installation, one of the two or three largest in the world. The Soviet trend toward large-scale production facilities also was illustrated in other sectors of the iron and steel industry in the construction of the world's largest blast furnace with a capacity of 2,000 cubic meters and the installation of open-hearth furnaces with capacities of 600 tons, the first of this size in the world.

Activities of the State Committee for Automation give promise of having a significant effect on the design of metallurgical equipment. Several major metallurgical plants, including that in Magnitogorsk, are to be developed as model enterprises of integrated mechanization and automation. The State Committee for Automation is working in conjunction with approximately 70 or 80 research and design organizations on the problems of technical reequipment of these metallurgical plants.

In spite of these significant accomplishments, Soviet machine builders have not kept pace with the demand for metallurgical equipment. This demand reflects both the magnitude of current and scheduled metallurgical projects of the Seven Year Plan and the fact that completion of older projects has lagged because of persistent underfulfillment in

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previous years of plans for production of metallurgical equipment, particularly rolling mill equipment. Difficulties encountered in planning, coordinating, and executing essential construction projects also have been a major cause of delays in commissioning new capacity.

Although it appears unlikely that machine builders will catch up fully with this demand in the present Seven Year Plan, shortages of equipment are not expected to prevent the iron and steel industry from either meeting or exceeding the goals for production in 1965. Increases in production of ferrous metals in 1959 and 1960 are ahead of the control figures for the Seven Year Plan. The Seven Year Plan for the iron and steel industry is formulated with considerable flexibility. Goals for construction of new capacity in the pig iron, crude steel, and rolled steel sectors are higher than necessary to permit attainment of the increases in production planned in each of these sectors. Substantial increases in production are expected (and are being realized) by reconstruction, modernization, and more intensive exploitation of existing facilities. Achievement of the goals for constructing new capacity would permit retirement of obsolete and inefficient equipment and perhaps permit some building up of a reserve of excess capacity.

Production of equipment for the pig iron and crude steel segments of ferrous metallurgy during 1959 and 1960 probably was already high enough to insure aggregate production of this type of equipment equal to the planned 33-percent increase above that achieved during 1952-58. On the other hand, construction of new capacity in both new blast furnaces and steelmaking has lagged behind schedule, apparently reflecting difficulties in coordinating and executing the ambitious construction program for ferrous metallurgy. Additions to capacity not only lagged behind the individual year plans for the first 2 years but also were made at an average rate less than required to meet minimum goals for total new capacity during 1959-65. The estimated average annual amounts of new capacity constructed during 1952-58 and 1959-60 and the average annual amounts planned during 1959-65 are shown in the following tabulation:

<u>Item</u>	<u>Million Tons</u>		
	<u>1952-58</u>	<u>1959-60</u>	<u>1959-65 Plan</u>
Pig iron	2.3	3.2	3.4 to 4.3
Crude steel	1.8	3.5	4.0 to 5.1

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During 1961-65, additional benefits are expected from the generally more favorable ratio of tons of capacity to tons of equipment that is associated with the trend toward large-scale blast furnaces and open-hearth and electric furnaces. In addition, the building of large oxygen converters could be especially helpful because requirements for both investment and equipment generally are lower for oxygen converters than for open-hearth furnaces. The USSR, however, is behind schedule in its program for converters and has sought to purchase L-D oxygen converters from Austria. Success in obtaining such equipment, of course, would help to ease the burden on domestic producers of equipment as well as provide the USSR with valuable steelmaking technology. Considering the shortfall in adding capacity in 1960, fulfillment of the 1961 Plan might so strain the resources of the metallurgical equipment plants that efforts to increase production of rolling mill equipment would be hampered.

In the case of rolling mill equipment, although the planned aggregate increase in weight of equipment produced during the Seven Year Plan is more substantial than that for blast furnaces and steel smelting equipment (75 percent instead of 33 percent more than the corresponding amount in the previous 7-year period), the increase in the rate for adding new capacity for rolling steel is considerably higher than those for making pig iron and crude steel. Approximately 23 million to 29 million tons of new capacity are to be added compared with only 6.9 million tons in the preceding 7-year period, or an increase of from 230 to 320 percent. Results in the first 2 years of the Seven Year Plan appear rather impressive with 7.0 million tons of rolled steel capacity added, thus fulfilling the plans for these 2 years. Several factors, however, make this achievement somewhat less impressive. Much of the equipment installed and brought into operation in 1959 and 1960 actually was produced in earlier years. Thus the Seven Year Plan has benefited by the windfall represented by these completions of long-delayed projects. In addition, most of the finishing capacity that is required as a follow-up to installed capacity for continuous hot rolling (sheet) has yet to be added. For these and other major scheduled projects, cold rolling mills are needed to permit the substantial increases planned in cold-rolled strip and sheet products. The magnitude of this task is indicated by the fact that the continuous cold sheet mill completed in 1960 was only the second or third of this kind produced by the USSR, whereas the Ural Heavy Machinery Plant (Uralsmash) at Sverdlovsk is to produce more than 20 cold rolling mills of various types by 1965. The broadened goals of product-mix for the iron and steel industry also increase requirements for related processing equipment such as continuous lines for tinning, galvanizing, pickling, annealing, and tempering. In addition, projects for installation of new capacity for pipe and tube are lagging behind schedule.

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In the metallurgical equipment industry, progress has been reported on projects for the expansion and improvement of existing production facilities, primarily at the two major plants -- Uralmash and Novo-Kramatorsk. At the former a number of existing shops are being reconstructed and new ones built, including a large welded metal structures shop. Other measures adopted by Uralmash to improve the caliber of design and production work include the expansion of training programs for technical personnel and the establishment of a new institute at the plant, the Scientific Research, Design, and Technological Institute for Heavy Machine Building.

At Novo-Kramatorsk, 200 new machine tools reportedly were installed in mechanical shops in 1960, and increased quantities of steel were made available by enlargement of open-hearth furnaces at the plant.

No specific information is available concerning progress during 1960 on the planned expansion of the Southern Ural Heavy Machinery Plant at Orsk, but reports of increased production activity suggest that some improvement or expansion of plant facilities has been made. The plant produces blast furnace equipment, steel-pouring ladles, rolling mills, and sintering equipment. In addition, it has become a major supplier of equipment for continuous casting installations. Delays have been encountered, however, in expanding the size of the design staff at the plant because of a lack of housing.

Although most capital investment appears to be directed toward the improvement and expansion of existing plant facilities, another important project of the Seven Year Plan calls for construction of a new plant in Petropavlovsk for production of rolling mill equipment. According to one report released in 1959, construction of the plant was not scheduled to begin (or rather be resumed, because some construction activity was reported as far back as 1957) until 1961. It was reported in September 1960 that construction would not begin until 1962. It now appears that this plant will be, at best, only in partial operation at the end of the Seven Year Plan period.

An inherent limitation on the wide use of mechanization and automation in production of metallurgical equipment is the fact that much of this equipment is custom-designed to meet the particular requirements of individual iron and steel plants. Nevertheless, some efforts are being made to use mechanized techniques in certain stages of the production process. Projects have been drawn up and partly carried out for the renovation of foundries at the Uralmash, Elektrostal', and Novo-Kramatorsk plants. Included are such measures as specialization in various departments of the foundry according to weight of castings produced and the use of continuous-flow techniques under conditions of small series production of castings.

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Some progress appears to have been made in the program for increasing the degree of specialization at major plants. The Elektrostal' Heavy Machine Building Plant has been cited by Soviet officials as an example of effective reorganization of production along more specialized lines. The plant is producing pipe-rolling mills, small and medium-size rolling mills, and ore-enrichment machinery. The growing requirements of the Soviet economy for pipe and tube products make production of pipe and tube rolling mills especially important. Reports of production activity at the plant generally support claims of progress toward the planned concentration of much of this equipment at Elektrostal'. Reports of production activity at other plants -- Uralmash, Novo-Kramatorsk, Staro-Kramatorsk, and Southern Ural -- also indicate that specialized programs are being developed along planned lines for production of rolling mill equipment. The full benefit from these measures, however, probably will be realized only after a period of several years as sustained use of improved production procedures permits reductions in the present lengthy lead times.

In spite of indications of progress in specialization programs designed to yield efficiencies in production, the USSR has clearly not demonstrated as yet that it has overcome many of the problems which have hampered production of metallurgical equipment, particularly rolling mill equipment. Lead times for the heavier, more complex mills, such as the continuous hot sheet mills installed in 1960, were considerably longer than is the case for Western producers of such equipment (4 or 5 years and even longer compared with about 2 years in the West). Delays have been encountered in the development of designs, in the scheduling and coordination of production, and in the execution of assignments of production and supply.

Soviet foreign trade in metallurgical equipment during the first 2 years of the Seven Year Plan appears to be following the pattern established during the decade of the 1950's. During this period the USSR was a net exporter of metallurgical equipment, even though domestic requirements were unsatisfied. The only favorable aspect of foreign trade, insofar as domestic industry was concerned, was the fact that imports of badly needed rolling mill equipment helped offset Soviet exports of such equipment. Imports of metallurgical equipment, in fact, were made up almost entirely of rolling mill equipment. The estimated volume of trade in metallurgical equipment in 1958-60 was as follows:

	<u>Thousand Tons</u>	
<u>Year</u>	<u>Exports</u>	<u>Imports</u>
1958	60.4	26.9
1959	59.2	20.9
1960	39.3	23.1

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Patterns in Soviet foreign trade in metallurgical equipment are expected to follow the trends already established. Czechoslovakia has agreed to supply 115,000 tons of rolling mill equipment to the USSR during 1961-65, and East Germany has agreed to increase its shipments of rolling mill equipment, although it has been experiencing difficulty in producing such equipment and may not be able to meet its export commitments to the USSR. Prospects for a moderate increase in Soviet imports from non-Bloc countries also are favorable. Export commitments, however, are expected to continue to be large in view of Soviet promises to ship metallurgical equipment to the Sino-Soviet Bloc and to underdeveloped countries.

One possible development that could reduce the burden on the USSR for equipment assistance to the European Satellites would be purchase by the latter countries of equipment from West Germany and other Western producers of equipment. Procurement efforts of this nature have already been made.

I. Turbines*

The Soviet turbine industry produced 9,200 mw of hydroturbines and steam and gas turbines in 1960. During the first 2 years of the Seven Year Plan period, Soviet production of turbines grew at an increasing rate, output in 1959 being 15 percent above that of 1958 and output in 1960 being 21 percent above that of 1959. An average annual rate of growth in production of about 15 percent is required during the last 5 years of the Seven Year Plan period in order to reach the minimum annual production goal for 1965 of 18,700 mw of new turbines. Although this required average percentage rate of growth is no greater than the rate achieved in 1959 and is less than that achieved in 1960, its attainment is not assured, because further growth in the industry is dependent not on utilization of previously unexploited production capacity but on the mastery of production of steam turbines of very large capacity. It will be necessary to adapt and expand existing facilities to permit small-series production of these turbines. The estimated production of turbines,

* The Soviet statistical data on which the estimates in this section are based include output of turbines for industrial and marine drives as well as for power stations. Of these applications, power stations accept at least 90 percent of the total production. This section is devoted almost exclusively to the supply of turbines for electric power stations, and it should be noted that production figures are overstated to the extent that they include gas and steam turbines for ships and industry.

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both actual and planned, for selected years is as follows:

<u>Year</u>	<u>Thousand Megawatts</u>
1958	6.6
1959	7.6
1960	9.2
1960 Plan*	13.1
1961 Plan**	11.8
1965 Plan	18.7 to 20.4

To a significant extent the increases in production in 1960 (measured in the megawatt capacity of the turbines) resulted from alterations in product design. The trend toward production of steam turbines with larger physical dimensions permitted production of turbines with increased capacities requiring less than a commensurate increase in expenditures of productive effort. The trend toward production of turbines with steam inlet conditions of higher temperatures and pressures resulted in 1960 in production of several large turbines that were rated at higher capacities than would have been the case if they had been designed for the lower steam parameters commonly specified in previous years. It seems probable, however, in view of the lack of mention in the Soviet press of completed new construction at turbine plants in 1960, that the major portion of the increase in output of turbines was obtained from the fruition of efforts begun in earlier years to reorganize and reequip existing production space for production of turbines of larger capacity.

The ability of Soviet builders of turbines to produce large units in sizable quantities will be the most significant factor in attainment of the goal of the Seven Year Plan. In producing hydroturbines of large capacity, the USSR has attained world leadership. During 1960 the first two 230-mw turbines for the Bratsk Hydroelectric Power Station were completed, and 300-mw and 500-mw units were under development. Approximately 10 million kilowatts of hydroelectric capacity are planned for installation during the current plan period, and it is quite possible that an effort will be made to exceed this goal. In steam turbine technology the USSR is behind the US, although some of the newer Soviet turbines are fairly close to the operating characteristics of large-capacity

* Goal of the Sixth Five Year Plan for 1960.

** Implied from discussions in the Soviet press of increases planned in production of important types of turbines.

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steam turbines recently installed or scheduled for installation in the next 2 or 3 years in the US (pressures of 2,000 to 2,400 pounds per square inch [psi] and temperatures of 1,000 to 1,050 degrees Fahrenheit). Still further progress in this direction was made by the USSR with the recent completion of a prototype 300-mw steam turbine designed to operate at 240 atmospheres (3,528 psi) and 580 degrees Centigrade (1,076 degrees Fahrenheit). Service tests are not yet completed, but the designed operating characteristics of this turbine are slightly higher than all but two of the most advanced thermal power stations in the US. Technical problems remain to be solved, and although the USSR has built about a dozen 200-mw steam turbines, only one is in operation. The first, built in 1957, is not yet in regular operation. In mastering production of gas turbines, the USSR has encountered persistent difficulties. Thirty-six 4-mw units reportedly were completed and shipped to installation sites in 1960, but none had been put into operation, because they were still undergoing adjustments to correct deficiencies in design and defects in components. Similarly, difficulty was experienced in completing a 12-mw gas turbine. Although reportedly completed in 1956, this turbine apparently did not pass its acceptance tests until 1959. Nevertheless, the USSR is attempting to become a world leader in production of large-capacity gas turbines. A 25-mw gas turbine reportedly was nearing completion in December 1960, and 50-mw and 100-mw units also were under development.

Soviet builders of turbines also have made some significant gains in production technology. In the manufacture of the 230-mw hydroturbine, electroslag welding was utilized in the assembly of the rotor, reportedly at a saving in material and labor. New high-productivity techniques and equipment reportedly are being employed in the manufacture of rotors of stationary gas and steam turbines, in the tapping of large holes, in the machining of turbine blades, in the introduction of shrink fits by means of artificial subzero cooling, and in the use of welding for the fabrication of large rotors for steam turbines.

These innovations in production will be needed to compensate for what seems to be a lag in the expansion of plant facilities. Work is proceeding slowly both in the modernization of production facilities and in the construction of new research facilities. During 1961, however, it appears that the increased investment which is to be allocated to the turbine industry will be concentrated on the expansion and modernization of existing enterprises.

Exports of turbines absorb a surprisingly large part of production. In the first year of the Seven Year Plan, exports of Soviet turbines are estimated to have reached a record high of 1,598 mw, or 2.5 times the volume of such exports in 1958. The principal recipients

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were Poland, Bulgaria, and Communist China. In 1959, China alone is believed to have bought steam turbines from the USSR with a total capacity of more than 1,000 mw. Exports of hydroturbines, however, were comparatively small in 1959, with 70 mw going to China and another 30 mw principally to the underdeveloped countries of the Free World. Altogether, exports of turbines in 1959 represented 21.0 percent of domestic production, a sharp contrast to 1958, when exports constituted only 9.8 percent of production. Exports in 1960, which amounted to 1,484 mw, or 16.1 percent of domestic production, receded somewhat from the high of 1959 both in absolute terms and as a percentage of domestic production, primarily because of a cutback in shipments to Communist China, which, in spite of this cutback, probably remained the principal recipient of Soviet exports of turbines in 1960. During the remaining years of the plan period, exports of turbines are expected to rise to new levels. Present indications are that exports of turbines in the next several years will be about 2,000 mw per year and may rise to approximately 3,000 mw per year by 1965. Plans call for the installation of roughly equal amounts (in terms of capacity) of hydroturbines and steam turbines at Soviet foreign aid projects. The balance could be tipped in favor of steam turbines, however, by construction and installation delays at hydroelectric power projects. From 1959 through 1965, China alone may require Soviet turbines exceeding 8,000 mw in capacity. Of this amount, about 6,000 mw are now expected to be hydroturbines, marking significant planned changes toward much greater use of hydroelectric projects than previously planned. Delays in the completion of hydroelectric projects in China, however, may reduce requirements for Soviet turbines during the plan period, as would a significant improvement in Chinese capabilities for production of turbines.

During 1959-60 the USSR is believed to have imported mainly hydroturbines and gas turbines. The total imports of turbines increased from 9.9 million rubles in 1958 to 13.8 million rubles in 1959.* The Soviet imports of gas turbines in 1959 reflected the inability of the USSR to satisfy its growing requirements for such equipment for its industrial programs, particularly pipeline transmission projects. This interest in acquiring gas turbines, which are procured from the industrialized non-Bloc countries, is expected to continue for the next several years.

J. Construction Equipment

The Soviet construction equipment industry appears to have been in serious trouble by the middle of 1960. The industry had failed to reach the annual plan goal for 1959 in several of the most important types of equipment, and it was evident that the industry would make an even poorer showing in 1960. Two key types of equipment, excavators and

* Data in terms of generating capacity are incomplete for 1959.

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motor graders, had an average annual rate of growth in unit production of 10 percent and 8.5 percent, respectively, during the first 2 years of the Seven Year Plan, yet both failed to meet annual plan goals. The estimated production of selected products of the construction equipment industry, both actual and planned, for selected years is as follows:

<u>Item</u>	<u>1958</u>	<u>1959</u>	<u>1960</u>	<u>1961 Plan</u>	<u>1965 Plan</u>
	<u>Units</u>				
Excavators	10,165	10,210	12,290	15,265	24,400
Bulldozers	10,963	11,264	11,200	19,500	24,500
Scrapers	2,660	2,398	2,950	4,950	8,450
Motor graders	2,663	2,835	3,135	3,650	10,000
Loaders	N.A.	N.A.	2,600	3,960	N.A.
Truck cranes	6,867	7,079	6,335	8,000	13,000
Pneumatic-tire cranes	475	693	835		
	<u>Million Rubles</u>				
Spare parts	N.A.	N.A.	639	765	1,750

The July 1960 Plenum of the Central Committee of the Communist Party, USSR, authorized a supplementary capital investment in the construction equipment industry, enumerated the weaknesses that should be rectified, and drastically increased production goals for the remaining years of the Seven Year Plan. It is believed that the allocation of 867 million rubles to supplementary investment increased the total planned investment for the construction equipment industry by approximately 20 to 25 percent to a total of 4 billion to 5 billion rubles.

The July 1960 Plenum also directed that there be corrected such shortcomings as insufficient plant capacity, insufficient capital investment, inadequate supply of principal components purchased from suppliers, poor industrial management procedures, and inadequate specialization of plants. The key factor, however, in the inability of the construction

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equipment industry to fulfill annual plan goals in 1959 and 1960 is believed to have been inadequate capacity. Seventeen new or converted plants are known to have begun producing construction equipment during the first 2 years of the plan period, but many of these either were not yet in full production by the end of 1960 or were producing small quantities of extremely large excavators. The annual plan for 1959 called for new capacity for producing 1,800 excavators, but capacity for only 1,300 excavators actually was brought into use by the end of the year. In the construction equipment industry as a whole, only about 85 percent of the capital investment planned for 1960 was completed. This additional capital investment allocated in mid-1960 undoubtedly will increase the capacity of the industry, but it is unlikely that this new capacity could have appeared soon enough to have contributed significantly to the fulfillment of the revised annual plan for 1961. Apparently the goal for 1961 called for increases in unit production ranging from 16 percent for motor graders to 74 percent for bulldozers.

There has been a great deal of lip service but very little actual progress in the programs to increase mechanization and automation of production facilities and to standardize parts and components. Moreover, in the specialization of production facilities the construction equipment industry appears to have lost ground. Production of tower cranes, for example, continues to be as chaotic as in the days before the administrative reorganization of industry in spite of a barrage of complaints in the press and of several plans to reduce the number of producing plants and to consolidate the types and sizes of cranes produced. The same complaint is now beginning to be used against plants producing large rotary excavators, charging that each plant is going its own way in regard to equipment specifications. For both tower cranes and rotary excavators the weakness appears to be in the failure to designate principal producing plants and to establish a main institute to formulate a unified production policy and program. Also, the plants of the construction equipment industry are often loaded with production responsibilities other than those for construction equipment, and an increasingly large number of plants of other industries are producing construction equipment as a secondary product. The July 1960 Plenum attempted to discourage this practice by making it necessary for a plant manager or a Sovnarkhoz administration to obtain the approval of the council of ministers of the union-republic and of Gosplan, USSR, before any plant of the construction equipment industry could change its designated area of specialization. The action of the Plenum apparently has not completely changed conditions, however, for in January 1961 one of the principal excavator plants was to begin producing spare parts for grain combines.

Even more characteristic than the lack of proper specialization of plants is the industry's slowness in initiating production in quantity of certain types of modern construction equipment. This fundamental and

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longstanding weakness has been given considerable attention in the press, and little or no improvement has been made during the first 2 years of the plan period. Modern self-propelled wheeled equipment (scrapers, bulldozers, loaders, rollers, and cranes), particularly those capable of handling heavy loads, either are produced in inadequate quantities or not at all. The construction equipment industry is not entirely at fault for this particular shortcoming. This industry is dependent on other industries for major components, without which it cannot complete the assembly of its products. Currently lacking are certain types and sizes of hydraulic drives, electrical equipment, earthmover tires, tractors of more than 150 horsepower, diesel engines with aircooling, and diesel engines of more than 150 horsepower. Unless the tractor industry, the motor vehicle industry, the chemical industry, and other pertinent industries begin to produce the volume and quality of parts and components needed by the construction equipment industry, the series production of certain modern construction equipment will fail to materialize.

The Soviet construction equipment industry is unable to shift the blame for the continued inadequate supply of spare parts for construction equipment. Remedial action has been stipulated, which, by 1965, is expected to result in nearly trebling output of spare parts. This action includes the designation of specific plants to specialize in the large-volume production of spare parts.

The estimated trade in the principal categories of construction equipment in 1960 was as follows:

Item	Exports		Unit Exports or Imports as a Percentage of Production	1960 Unit Exports or Imports as a Percentage of 1959 Exports or Imports
	Units	Value (Million Rubles)		
Construction equipment		165.4		
Of which:				
Truck cranes	275	13.7	N.A.	125.0
Pneumatic-tire cranes	36	5.5	N.A.	120.0
Excavators	722	52.6	5.9	123.4
Towed graders	64	1.1	N.A.	64.6
Motor graders	202	8.9	6.4	144.3
Bulldozers	739	38.6	6.6	93.5
Tractor scrapers	387	19.9	13.1	138.2
Motor rollers	93	2.4	N.A.	75.6
<hr/>				
	Imports		Unit Exports or Imports as a Percentage of Production	1960 Unit Exports or Imports as a Percentage of 1959 Exports or Imports
	Units	Value (Million Rubles)		
Construction equipment		39.2		
Of which:				
Caterpillar cranes	163	19.5	N.A.	140.5
Excavators	9	13.5	0.1	47.4

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Soviet foreign trade in construction equipment increased substantially during 1960. Exports increased from 138.0 million rubles in 1959 to 165.4 million rubles in 1960, an increase of 20 percent. Imports showed a much smaller absolute growth, rising from 31.3 million rubles in 1959 to 39.2 million rubles in 1960, an increase of 25 percent. The Sino-Soviet Bloc continued to be the major purchaser of Soviet construction equipment, buying equipment worth 116.5 million rubles, or about 70 percent of the total in 1960. Furthermore, the underdeveloped countries of the Free World are believed to have imported equipment worth almost 42.6 million rubles, or virtually all of the remainder. During 1960, all but a very small portion of Soviet imports of construction equipment continued to come from Czechoslovakia and East Germany.

Throughout the remaining years of the Seven Year Plan, there probably will be a gradual increase in the volume of Soviet foreign trade in construction equipment. The Sino-Soviet Bloc undoubtedly will remain the principal trading partner of the USSR, although the Bloc's percentage of the total Soviet exports may decline slightly in favor of the underdeveloped countries of the Free World. Czechoslovakia alone is to receive 1,240 Soviet excavators during 1961-65, and, of the non-Bloc countries, Argentina, Yugoslavia, Cuba, Indonesia, Greece, Turkey, and Egypt are expected to continue to be important purchasers of Soviet construction equipment.

K. Chemical Equipment

Production of chemical equipment in the USSR rose in startling fashion in the first 2 years of the Seven Year Plan period. In 1959 it increased to 57 percent above the level of 1958, and in 1960, valued at 2,240 million rubles, it had grown to 27.5 percent above the level of 1959 and was double the amount reached in 1958. The planned rate of growth of output of chemical equipment in 1961 is 27 percent, almost the same rate as was realized in 1960. If this rate of growth is continued through 1962, there will be produced in that year as much chemical equipment, expressed in terms of value, as was planned for 1965. It is therefore likely that output in 1965, in terms of value, will greatly exceed the plan. The estimated annual production, both actual and planned, for selected years is as follows:

<u>Year</u>	<u>Million Rubles</u>
1958	1,121
1959	1,757
1960	2,240
1961 Plan	2,840
1965 Plan	3,500 to 3,700

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The increases in production during 1959 and 1960 were obtained primarily by expanding production facilities of the plants that had been producing chemical equipment and by initiating production of chemical equipment at plants not previously so engaged. It also seems probable that production of chemical equipment was started in 1960 at some of the 15 new plants that are being built for that purpose during the Seven Year Plan period even though the construction of a third of these new plants was behind schedule in 1960. The existence of this large construction program, which is slated for fruition in the next few years, gives promise of continued rapid growth of output with fulfillment of the 1965 goals as early as 1962 as a possible result.

The fact that production is measured in terms of value requires some caution in evaluating the apparently phenomenal growth of the industry. Because plants that are newly engaged in production of chemical equipment naturally have higher costs than experienced plants and because the cost of producing new types of equipment was greater than anticipated, the value of actual production is not likely to represent the amount of equipment that was included in the planned value of output.

During the first 2 years of the Seven Year Plan, although production was rising rapidly, few changes were introduced in product technology. Improvements were made in some models of pumps and compressors, but no major types of new equipment were brought into production. The industry, however, is planning to produce a wider range of products and to improve existing models and, to that end, is engaged in extensive developmental work. Some of the advanced equipment imported from the industrial West undoubtedly will be copied by the domestic industry. The program of substituting plastic materials for metals in component parts achieved some success, particularly in the increased use of plastics in pump components.

Although some attention has been given by the chemical equipment industry to specialization of production facilities and to standardization of component parts, the Soviet program of complex mechanization and automation has not been generally applicable to this industry, because, as a general rule, chemical equipment must be custom-designed and fabricated.

The USSR, in spite of its success in accelerating domestic production of chemical equipment, relies heavily on imports to meet the needs of the chemical industry. Imports of chemical equipment are essentially of two types. From the European Satellites the USSR imports large amounts of chemical equipment, similar to the equipment produced in the USSR, thus supplementing domestic production; and from the industrial West, particularly Western Europe, the USSR imports chemical equipment and plants that incorporate advanced design and technology not

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generally available in the Sino-Soviet Bloc. Because of the backwardness of the chemical technology of the Bloc, the USSR is obliged to continue and even to increase the high level of imports of chemical equipment, plant, and technology from the West. It is estimated that Soviet imports of chemical equipment, plant, and technology from the West during 1959-65 will amount to from 0.75 billion to 1.5 billion dollars. Soviet imports of chemical equipment* during 1958, 1959, and 1960 were as follows:

<u>Imports</u>	<u>Million Rubles</u>		
	<u>1958</u>	<u>1959</u>	<u>1960</u>
From the Bloc	124.4	149.7	201.0
From outside the Bloc	78.0	311.1	546.0
Total	<u>202.4</u>	<u>460.8</u>	<u>747.0</u>

As this tabulation indicates, the proportion of imports from non-Bloc countries rose from 39 percent of the total in 1958 to 68 percent in 1959 and 73 percent in 1960. Because the USSR is particularly interested in importing equipment, plant, and technology for production of petrochemicals and synthetics, the proportion of imports from non-Bloc countries may increase even further during 1961-65. Within the Bloc, Czechoslovakia in 1960 replaced East Germany as the major supplier of chemical equipment to the USSR. Imports from East Germany, however, will continue to be substantial throughout the remainder of the Seven Year Plan.

L. Machine Tools

Production of metalcutting machine tools in the USSR increased 6.5 percent in 1959 and 4.8 percent in 1960. These moderate rates of growth would have been sufficient, if continued, to reach the original goal of the Seven Year Plan of 190,000 to 200,000 metalcutting machine tools in 1965. With the appearance in the Ekonomicheskaya gazeta of 17 May 1961 of a reference to the previously unpublicized new goal for 1965 of 270,000 metalcutting machine tools, however, and the subsequent confirmation of this figure by the Director of the Experimental Scientific Research Institute for Metalcutting Machine Tools in an interview with a US diplomat, it has become evident that the requirements of Soviet industry for metalcutting tools have been revised sharply upward. The new goal is predicated on an accelerated investment program that includes the construction of "tens of new plants."

* Perhaps not including pumps and compressors for use in chemical processes.

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Increases in the estimated production of particular metalcutting machine tools in 1960 compared with that in 1959 as announced in the Soviet press are as follows:

<u>Item</u>	<u>Percent Increase</u>
Precision lathes	75.7
Centerless grinders	46.1
Copy-millers	28.8
Gear grinders	17.8
Special cutting machine tools	8.1

Production of metalforming machine tools in 1960 surpassed the original 1960 goals of the Sixth Five Year Plan, and in December 1960 the modest target of the Seven Year Plan of 36,200 units in 1965 was raised to 55,000 units. The new plan goals for metalforming machine tools pose a challenge to the capabilities of this industry, but the USSR may be able to reach a level of about 50,000 units by 1965. The estimated production of machine tools, both actual and planned, for selected years is as follows:

<u>Item</u>	<u>Thousand Units</u>				
	<u>1958</u>	<u>1959</u>	<u>1960</u>	<u>Original 1965 Plan</u>	<u>Revised 1965 Plan</u>
Metalcutting tools	138	147	154	190 to 200	270
Metalforming tools	26.2	29.3	29.5	36.2	55
Total	<u>164</u>	<u>176</u>	<u>184</u>	<u>226 to 236</u>	<u>325</u>

A major expansion of plant capacity is partly responsible for the increase in production of metalcutting machine tools in the first 2 years of the Seven Year Plan and for the anticipated growth in the remainder of the plan period. In 1960, at least 10 existing plants producing metalcutting machine tools were undergoing expansion, and new plants for producing metalcutting machine tools were under construction in the Armenian, Latvian, and Lithuanian SSR's. None of the new plants began production in 1960.

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The metalforming branch of the industry, however, by the end of 1960 had experienced very little expansion of existing plant capacity and almost no new construction. The lack of an expansion program results from the original goal of the Seven Year Plan, which called for only a moderate increase in production of metalforming tools. With the announcement in 1960 of the raising of the target for 1965 from 36,200 metalforming tools to 55,000 units, the outlook has changed considerably. In 1962-65 the metalforming branch is to receive an investment three times that originally planned. Old plants will be expanded, and a number of new specialized plants producing particular models of metalforming machine tools are to be built, including at least one plant that is to specialize in producing automation equipment for use with metalforming tools.

In addition to expansion of production capacity, the industry has benefited in varying degrees from advances in the fields of specialization, standardization, and automation, as described below. It is believed that no major problems affected production of machine tools in 1960. There is no evidence of shortages of labor or materials, and the occasional dislocations in production were confined to a few plants and models.

The Soviet program of specialization of production facilities has been implemented to a considerable degree in the metalcutting branch of the industry. Plants in Moscow, Leningrad, Vitebsk, Kuybyshev, and other cities have dropped production of a number of models previously made in order to specialize on a few models, but the success of this program cannot yet be evaluated.

Since 1958 the Soviet machine tool industry has reached a relatively advanced stage in the standardization of component parts and sub-assemblies. At the Ordzhonikidze plant in Moscow, which produces transfer lines and special machine tools, 85 to 90 percent of the products are composed of standardized components that are common to more than one product. During 1960, emphasis was given to the standardizing of auxiliary equipment used in conjunction with machine tools. Designs and standards established for these auxiliary items will be used in actual production later in the Seven Year Plan.

Automation and complex mechanization have been employed for several years more extensively in the USSR than in any other country of the world in producing metalcutting machine tools. Further progress was achieved in 1960 by installing conveyors, or production flow lines, in six additional machine tool plants.

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The USSR is carrying out a program, within the provisions of the Seven Year Plan, for the modernization of 400,000 machine tools, amounting to about 20 percent of the inventory of 1960. Although this modernization is being effected locally by the plants in which the machine tools are located, the program represents an achievement of the machine tool industry, which worked out the modifications, prepared the necessary instructions, and, in some cases, manufactured the necessary replacement parts. Usually, changes involved increases in speed, feed, and an added degree of automaticity and precision and provided for an increase in productivity of about 25 percent. It is estimated, on the basis of a Soviet press announcement, that the modernization program in 1960 reached the annual goal and that the Seven Year Plan will be achieved.

During the first 2 years of the plan period, the machine tool industry continued to show rapid progress in mastering new technology. A number of new models of machine tools were constructed in 1960, including such metalcutting machines as jig borers, small module gear-making machines, and honing machines. Automated types of machine tools included semiautomatic and fully automatic machine tools, prototypes of program-controlled machines with electrical and mechanical programing controls, and new machines with electronic programing control that is actuated by punched cards and perforated tapes.

Some of the prototypes of metalforming machines built in 1960, such as high-speed hydraulic presses, rotary swagers, high-speed cold headers, and multistation mechanical presses are of types of machines principally used in producing consumer goods. The prototypes of both metalcutting and metalforming machines are much like Western models and are believed to be of higher quality than earlier Soviet models.

In 1960 the Soviet machine tool industry produced a larger proportion of automated types such as transfer lines and special-purpose automatic machines suitable for insertion into automatic lines. It has been announced that more than 150 automatic production lines were produced, and it is believed that the average number of stations per line has increased. In 1960, as many as 85 power units were used in an automated transfer machine tool line for the machining of engine blocks, whereas in 1959 the most complicated line for which information is available contained only 30 units. Most of the assembly lines built in 1960 were for the motor vehicle industry, and many of the rest were delivered to the bearings, agricultural machinery, and tractor industries.

Foreign trade in machine tools in 1960 changed in its pattern of distribution and increased in volume compared with trade in 1958 and 1959. Annual imports of machine tools remained less than 5 percent of domestic production, and exports were even less. About 80 percent of the imported machine tools came from the European Satellites, particularly East Germany, which alone supplied almost one-half of the total imports.

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In 1958 and 1959 the European Satellites had provided 90 percent of the total imports of machine tools, mainly of specialized and precision types, either not produced in the USSR or produced in small quantities. In 1960, Switzerland and West Germany were the chief Western suppliers of these types. About 80 percent of the machine tools exported in 1960 were shipped to countries of the Sino-Soviet Bloc, of which Communist China was the largest customer. The value of foreign trade in machine tools in 1958, 1959, and 1960 was as follows:

	Million Rubles		
	<u>1958</u>	<u>1959</u>	<u>1960</u>
Imports	312	328	404
Exports*	72	86	78

M. Mainline Locomotives and Freight Cars

Soviet production of mainline locomotives, which in 1959 had increased 36 percent above that of 1958, reached 1,699 in 1960, an increase of 18 percent above production in 1959. The trend in production of diesel locomotives continued upward in 1960, but a decline in production of electric locomotives reduced the aggregate rate of growth in the locomotive branch of the industry as a whole. Production of freight cars, which declined to 38,600 in 1959 from 40,300 in 1958 (a decrease of 4 percent), dropped to 36,400 in 1960 (a decrease of about 6 percent). Measured in terms of the carrying capacity of the total output of freight cars, there probably was no decline in production in 1960, because a larger portion of the total output was composed of six-axle and high-capacity freight cars (of 60 tons and greater). The estimated production of locomotives and freight cars, both actual and planned, for selected years is as follows:

	Units					
<u>Item</u>	<u>1958</u>	<u>1959</u>	<u>1960</u>	<u>1960</u> <u>Plan</u>	<u>1961</u> <u>Plan</u>	<u>1965</u> <u>Plan</u>
All locomotives	<u>1,056</u>	<u>1,437</u>	<u>1,699</u>	<u>1,743</u>	<u>2,128</u>	<u>3,105</u>
Diesel	<u>712</u>	<u>1,002</u>	<u>1,303</u>	<u>1,288</u>	<u>1,453</u>	N.A.
Electric	<u>344</u>	<u>435</u>	<u>396</u>	<u>455</u>	<u>675</u>	N.A.
Alternating current	1	42	98	N.A.	N.A.	N.A.
Direct current	343	393	298	N.A.	N.A.	N.A.
Freight cars	40,300	38,600	36,400	35,000	N.A.	N.A.

* Excluding exports of machine tools that were exported as part of complete plants, for the value is not known.

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Problems associated with the introduction of the alternating current (AC) electric locomotive into series production, particularly shortfalls in deliveries of rectifiers from the electrical industry, were responsible for the decline in production of electric locomotives in 1960. Most of the newly electrified Soviet railroads are designed for operation on AC. On these lines, direct current (DC) locomotives cannot be used. Officials of the Soviet Ministry of Railroads have complained publicly that the locomotive industry delivered 57 fewer AC locomotives than planned and 150 fewer than needed in 1960. The officials complained further that by January 1962 the Soviet railroads would need 200 AC locomotives more than they would have needed in spite of the fact that in 1960 the last of a lot of 50 AC locomotives, ordered from France, had been delivered and about 20 more from West Germany were expected in 1961. It is clear that the needs of the railroads for AC locomotives in 1960 exceeded the plans for production and import, as the underfulfillment of the 1960 Plan for producing AC locomotives was not large enough to include the total number that the Ministry of Railroads stated that the railroads should have received.

The known additions to the productive capacity of the industry in 1959 and 1960 were of a minor nature, consisting of the conversion of the Leningrad Locomotive Plant (formerly the Proletarskiyy Locomotive Repair Plant) for production of diesel-hydraulic locomotives (only one was assembled in 1960), the expansion of the Novocherkassk and Lugansk locomotive plants, and the addition of a building for the conveyORIZED assembly of freight cars at the Dneprodzerzhinsk Railroad Car Plant. For the most part, growth of output is to be obtained from increases in productivity. These increases are to be derived from increased mechanization (particularly conveyORIZATION) and the introduction on a larger scale of automatic work cycles in the fabricating processes.

Although in 1960 the only model of diesel locomotive in regular production was the TE-3, a diesel-electric locomotive of 2,000 horsepower (hp), prototypes of several other models were produced. These models consisted of a gas-turbine-electric locomotive of 3,500 hp, a passenger diesel-electric locomotive of 3,000 hp, and a diesel-hydraulic locomotive of 3,000 hp. The development and production of diesel-hydraulic locomotives is considered particularly important because they are less expensive to produce and because, having no heavy electrical equipment, they greatly reduce the use of copper, a critically short material in the Sino-Soviet Bloc. The Leningrad Locomotive Plant is being equipped to produce these locomotives.

The trend in production of freight cars toward a larger number of six-axle and high-capacity cars (60 tons and greater) continued in 1960. These larger cars are equipped with roller bearings, a practice

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that will become general for all railroad cars as rapidly as the anti-friction bearings industry is able to increase output of bearings of the appropriate size.

Foreign trade in mainline locomotives and freight cars in 1958-60 was as follows:

Item	Units					
	Exports			Imports		
	1958	1959	1960	1958	1959	1960
Locomotives	60	950	61	47	95	231
Freight cars	0	0	0	3,092	3,875	4,337

Exports of locomotives in 1958-60 consisted almost entirely of shipments of second-hand steam locomotives to Communist China. The doubling of imports of locomotives in 1959 in comparison with 1958 and again in 1960 in comparison with 1959 reflects both the present high level of requirements in the USSR for modern electric and diesel-electric locomotives and the newly acquired capability of Czechoslovakia to produce these locomotives. Of the 109 electric locomotives imported in 1960, France supplied 24 (AC type), and Czechoslovakia supplied 85 (DC type). Of the 122 diesel-electric locomotives that were imported, it is known that 20 came from Austria and 41 from Czechoslovakia. Locomotive imports are expected to continue at about the 1960 level through the remainder of the Seven Year Plan period.

Total imports of freight cars increased by about 460 in 1960 in comparison with 1959 as a result of an increase in imports of tank cars. Imports of freight cars in the remaining years of the Seven Year Plan period may continue to rise toward an annual volume of about 5,000.

IV. Foreign Trade

As expected, in view of the announced intentions of the USSR to increase rapidly the mechanization and automation of industrial processes and to triple the size of the chemical industry in the period 1959-65, imports of machinery and equipment rose during 1959 and 1960, and exports actually declined in 1960. These trends in foreign trade contribute both to an accelerated accumulation of stocks of producers equipment and to the introduction of new foreign technological processes and equipment designs.

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Soviet foreign trade in machinery and equipment rose by more than 51 percent in the first 2 years of the Seven Year Plan, from 7,438 million rubles in 1958 to 11,254 million rubles in 1960. Exports, which increased more than 50 percent in 1959 in comparison with 1958, declined slightly in 1960. However, the trend of the total trade in machinery and equipment to increase was supported in 1960 by a 24-percent increase in imports, raising the share of imports to about 59 percent of the total trade in 1960 compared with 54 percent in 1959. Imports of machinery and equipment from non-Sino-Soviet Bloc countries, which in 1959 amounted to 20 percent of the total of such imports, amounted to 28 percent of the larger total in 1960. In obtaining the increased share of the Soviet market, non-Bloc countries increased their shipments of machinery and equipment in 1960 by 56 percent in comparison with 1959.

Soviet imports of machinery and equipment from non-Bloc countries have additional significance because they are composed in large measure of high priority items that incorporate advanced technology and either are not produced at all by Soviet industry or are not produced in sufficient quantities. Machinery and equipment in this category that was imported from non-Bloc countries in 1960 included chemical equipment and complete chemical plants, instrumentation for industrial processes and research, and specialized or very precise machine tools. East Germany continued to supply the largest amount of machinery and equipment to the USSR in 1960, shipping in that year about 35 percent of the total of such Soviet imports, followed by Czechoslovakia with about 18 percent, Hungary with 8.6 percent, and Poland with 7.2 percent.

In 1960, Communist China received 44.2 percent of all Soviet exports of machinery and equipment and 51.5 percent of such Soviet exports to the Sino-Soviet Bloc. Altogether, the countries of the Sino-Soviet Bloc received 85.7 percent of the machinery and equipment exported by the USSR in 1960. Of the remaining 14.3 percent, the principal recipients were a number of underdeveloped non-Bloc countries. Exports of machinery and equipment for complete plants amounted to about 2.3 billion rubles, or one-half of all exports of machinery and equipment by the USSR in 1960. Trade in other major categories of machinery and equipment in 1959 and 1960 was as follows:

Item	Million Rubles			
	Exports		Imports	
	1959	1960	1959	1960
Electric power equipment	108.6	101.6	240.8	260.6
Excavators and road machinery	122.2	146.2	16.2	19.6

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Item	Exports		Imports	
	1959	1960	1959	1960
Instruments, laboratory and medical equipment, bearings, abrasives, and cutting tools	181.5	199.5	233.0	274.3
Agricultural machinery	115.0	169.7	43.2	38.3
Railroad rolling stock	309.2	32.5	754.4	856.0
Automotive transportation and garage equipment	630.8	615.9	205.7	262.3
Metalcutting machine tools	74.1	57.1	184.4	251.6
Forge-press equipment	11.7	20.6	143.7	152.7
Electrical equipment	95.3	94.7	127.2	189.5
Rolling mill equipment	25.8	33.1	121.5	126.1
Hoist-transport equipment	39.4	58.9	144.2	182.1
Equipment for the food industry and light industry	72.4	48.7	613.5	845.3
Equipment for the chemical industry	10.6	22.8	460.8	747.0
Equipment for the wood pulp-paper industry	1.1	3.0	116.8	134.5
Ships, marine equipment, ship hoists, and diving and port equipment	52.0	47.2	1,208.6	1,512.9

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